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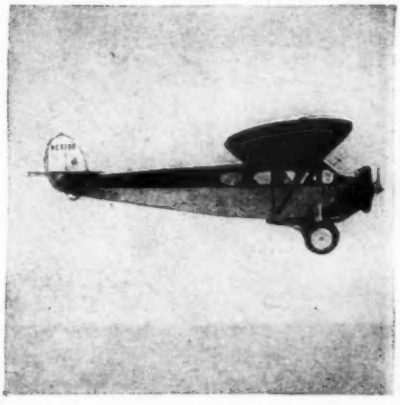

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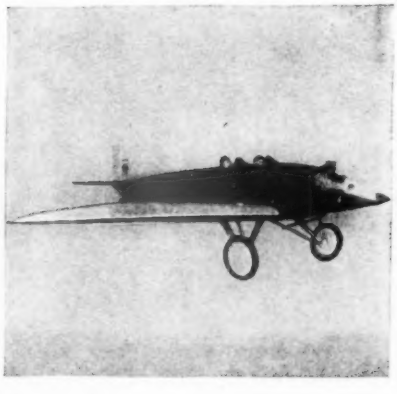

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POPULAR AVIATION AND AERONAUTICS

Published Monthly

Vol. 4, No. 2 | A magazine for everyone interested in aviation progress and development | February, 1929

Marchese de Pinedo

The Marchese de Pinedo has been made head of the Italian aeronautical general staff, succeeding the retiring General Armani. General de Pinedo has had a distinguished career. Besides having made a 30,000 mile flight from Rome to Japan and back, calling en route at Australia and the Philippines, he has twice crossed the Atlantic Ocean, once from east to west, and once from west to east. It is doubtful whether any living pilot has seen a greater variety of flying. POPULAR AVIATION AND AERONAUTICS extends to General de Pinedo the wish for a successful administration not only on behalf of the many friends the General made during his visit to the United States in the Santa Maria, but for air-minded Americans generally.

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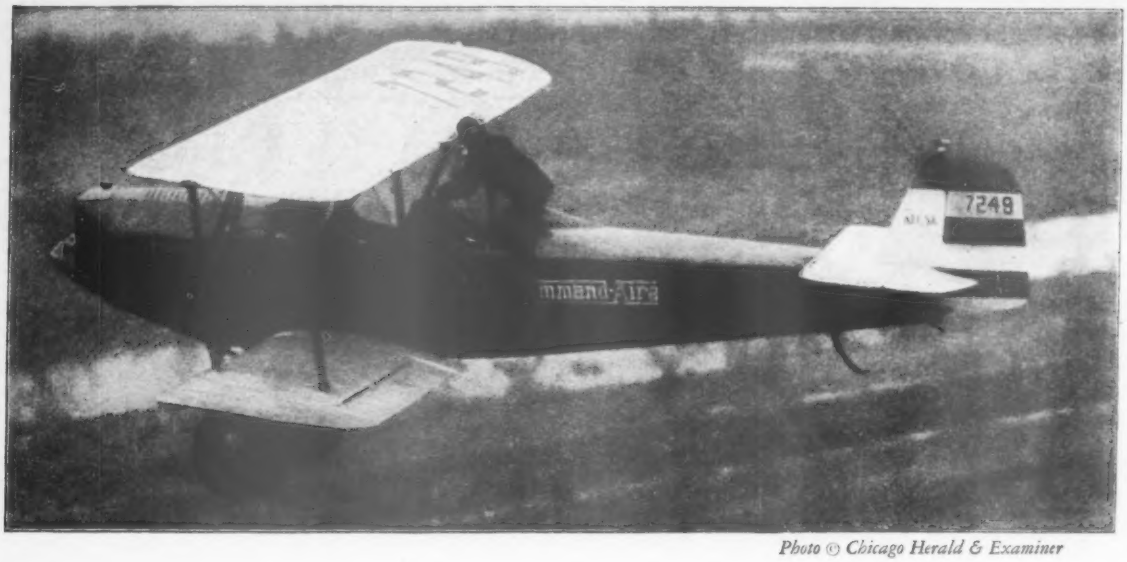

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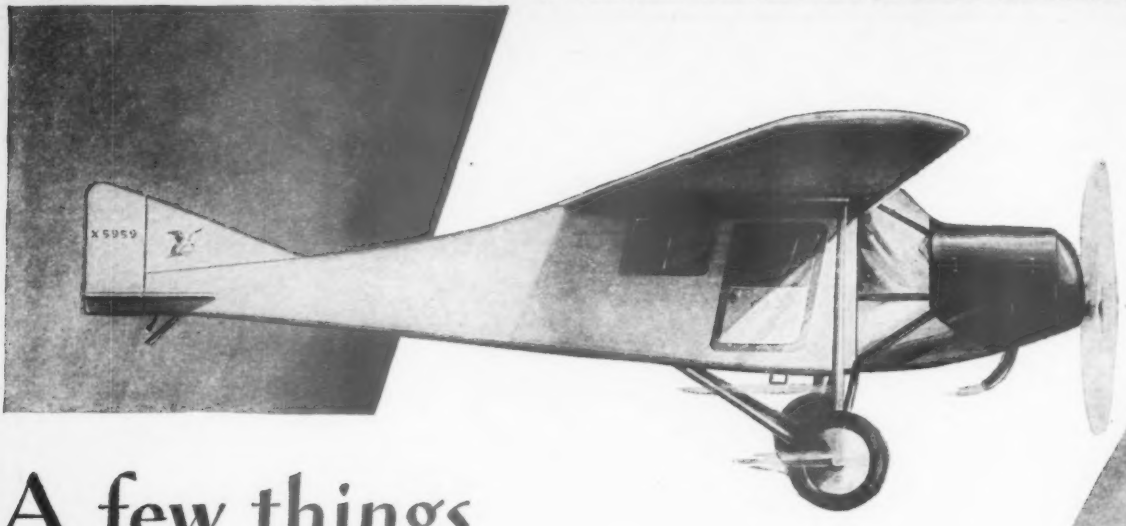

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Plant Protection by Airplane

By S. R. Winters

SCATTERING clouds of poisonous dust, the airplane is being underwritten as a form of insurance for agricultural crops against insect depredations and as a foe to mosquitoes and other pests that bother mankind. Down in the Cotton Belt of the South, the boll weevil, as it takes an annual cotton toll of $200,000,000, is subject to air attacks; the cotton-flea hopper, also destructive to our cotton cloth in the making, is receiving dosages of sulphur from airplane; out in the Middle West where wheat rust takes a heavy toll of our potential bread supply the spores or minute organisms responsible for the damage are being caught in airplane-traps; and at Quantico, Virginia,—the headquarters of the fighting Marines—poisonous Paris green is being sprayed, from sea-planes, onto mosquito-infested swamps.

It was seven years ago this August that the airplane was first introduced to the then spectacular undertaking of spraying insect-killing dust on destructive pests. The Air Service of the United States Army, in cooperation with the State Experiment Station of Ohio, launched a sweeping air attack against a swarm of insects that was stripping a grove of catalpa trees of their foliage. By the very daring nature of this innovation, the announcement of the attempt was received with skepticism—classified as a publicity "stunt" or a feat for exploitation by motion-picture producers. It fell into the same category, at least in the mind's eye of the public, with the subsequent undertaking of disintegrating river ice-formations by dropping bombs from airplanes or the more recent spectacular demonstration of the transfer of postal matter from a flying machine to a train. But the novel experiment of arresting tree-insect depredations was successful on its face value, and what was of far greater significance, it at once suggested the possibility of employing the airplane for the control of insect pests. From this feeble beginning emerged the definite project which has since consistently enlisted aircraft as the ally of plant protection against the attacks of insects.

One year later—in the cotton-growing season of 1922—the airplane was drafted as an instrument of warfare against the rapid and damaging encroachments of the cotton boll weevil—then as now under indictment for inflicting a $200,000,000 loss annually to cotton growers of the South. Two borrowed airplanes as well as pilots and other personnel and equipment, from the Air Service of the United States Army, furnished the basis for undertaking the tests. The poisonous dust, in the preliminary flights, was carried in bags and in limited quantities. The insecticide, consisting of calcium arsenate, was dropped onto the cotton fields over the side of the airplane by hand or poured through an opening in the bottom of the fuselage. Later, through the varying stages of evolution, came the hand-crank hopper and finally the air-suction hopper, which distributes the clouds of poisonous dust with an absence of human equation. Curiously enough, the first application of the airplane as an agency of insect control in cotton field was evidently fraught with such misgivings that the attacks were not directed against the boll weevil at all. Instead, the cotton leafworm which, as the term implies, feeds on the plant leaf and is clearly exposed, was the object of the preliminary airplane flights.

It is a far cry from the initial test flights in Louisiana in 1922 to the well-defined, officially approved project of cotton-dusting from the air in 1928. The field laboratory at Tallulah, La., owned and operated by the Bureau of Entomology of the United States Department of Agriculture, is composed of five buildings and, including the flying field, the laboratory grounds cover about seven acres. One of the photographs illustrating this article shows the flying field, in the foreground of which is a fleet of five airplanes. The latter no longer constitute borrowed property—the Department of Agriculture having purchased three planes outright and the United States Post Office Department, upon withdrawing from the actual operation

One of the big duster airplanes used for cotton protection.

of air-mail planes, donated two fully equipped De Havilands to the project of cotton-dusting. And, quite recently, the Department of Agriculture purchased a Stinson Detroiter—with its modern conveniences and luxuries of airplane controls that are well-nigh automatic in operation and closed cabins.

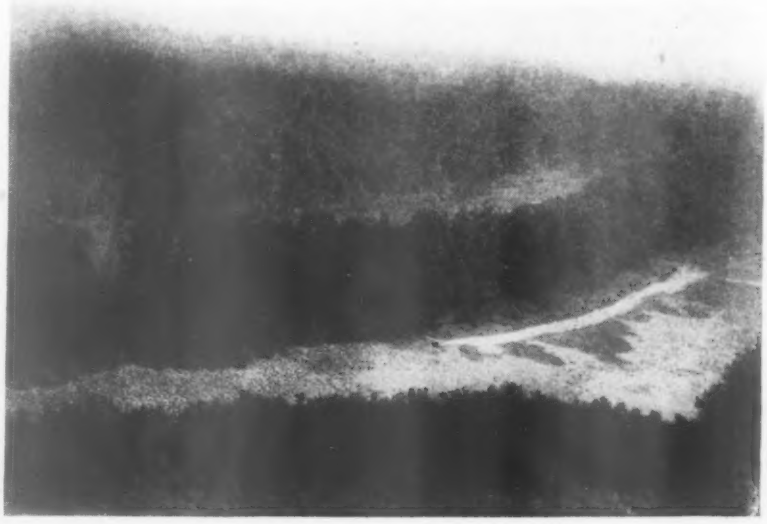
The flying personnel at the Tallulah laboratory consists of two pilots, one mechanician, three machinists, and one general engineer. This field station, while primarily dedicated to studies in devising means for the effectual control of the cotton boll weevil, is not restricted to the airplane as a combat method. The appropriation to be expended during the current year in making warfare on this pest amounts to $169,920. Of this sum, one-fourth or approximately $43,000 will be utilized in experiments with air-craft as the agency of combat. The tests are largely confined to Louisiana, although the airplane—in its sweeping reach—may fringe the borders of Arkansas and Mississippi in cotton-dusting operations. The Government experiments have answered, in the affirmative, the three question-marks that were so conspicuous during the preliminary tests of six years ago, namely: Can the planes be operated over a cotton field in such a manner that the field will be thoroughly subjected to the cloud of dust? Can the dust be forced down from the plane into the cotton plants and be made to adhere to them in a quantity sufficient to control insects? Can dusting be done economically from the air?

The latter question is answered by the Department of Agriculture with a proviso, namely, "The operation could be only considered as a community affair or for planters whose acreage would be large enough to justify purchasing more than one plane. Many districts in the South have now reached the point in public sentiment where the desirability of community weevil control can be seen, and it is only by some such method as the use of the airplane that such community poisoning can be attempted in the near future." This serves to introduce the commercial airplane cotton duster—just as commercial flying concerns are now carrying the mails, fighting forest fires, and making airplane surveys and maps of cities. The commercial cotton duster—notably, the Huff-Deland Dusters Corporation—may be hired by cotton farmers whose crops are infested with ravaging insects. This and similar organizations furnish the airplanes, pilots, the insecticides, and other equipment necessary to adequate dusting operations. The cotton grower pays a stipulated figure for each acre dusted, and the dusting corporation offers its services to any community guaranteeing at least 5,000 acres of cotton to be sprayed by insecticides from airplane. The cost to each farmer does not exceed that of ground methods of applying the poisonous dust—the one-mule dusting machine, for example.

The so-called air-suction hopper, by virtue of which the poisonous dust is sprayed automatically and uniformly onto cotton fields, is the interesting mechanism identified with airplane cotton dusters. It evolved from the crude method of dropping bags of insecticide over the side of an airplane to a feeder that is entirely automatic in its function. By means of this device, the poisonous dust is conveyed from the hopper by air suction, created by the stream of air flowing down through the hopper. This air is collected by a funnel pointing forward over the plane wing, and the velocity of the air thus harnessed is determined by the speed of the airplane, and the amount of suction created is, in turn, proportional to the speed of the flying machine.

This principle has been repeatedly tested by the Bureau of Entomology—a series of straightaway flights being made over a stretch of fields, with as much variation as possible in the speed of the plane. The same amount of dust (120 pounds) was loaded into the hopper for each flight and the flights were started at the same point. The time requirement for emptying the hopper was varied from 45 seconds to 2 minutes and 22 seconds. In every instance the hopper was emptied in the same distance—5,470 feet. The ground speed, therefore, ranged from 31.2 to 90 miles an hour. "The fact," reports the Government entomologist, "that the hopper discharge lasted exactly the same distance indicates

Dusting a swamp to kill mosquito larvae.



that, in straightaway flights at least, the use of air suction for dust delivery provides an automatic compensation for variation in plane speed. These figures were, of course, made with the feeder valve wide open and the dust delivery at the heaviest rate provided in any of the experimental work. More erratic figures probably would be obtained on reduced deliveries, but this point was not tested. The records obtained indicate that to treat cotton at the rate of 6 pounds per acre it is necessary for the plane to cover a swath 160 feet wide, or if this figure is reduced to 2 pounds per acre it will be necessary to treat 480 feet at each trip.

"These figures are very satisfactory for straightaway flights, but when short flights were made, with the plane operating back and forth over the field, somewhat different results were obtained. In fact, variation in the feed was noted to some extent in the straightaway flights. When first opened, with a full load of dust in the hopper, the feed was not very heavy, but as this dust quantity became reduced somewhat the feed increased until it quickly reached a maximum delivery, which was maintained throughout practically the remainder of the flight. In other words, the dust delivery was to a slight extent dependent on the amount in the hopper, even in straightaway flying. In flying back and forth over a field where the strips were rarely more than 600 to 700 feet long, this undesirable feature was more accentuated. Not only was the dust feed lighter when the hopper was full, but usually when the valve was thrown open it took a few seconds for the dust to reach its maximum delivery, and in those few seconds the plane travelled a considerable distance." Anyway, refinements and adjustments have been made in the air-suction hopper until it executes its function of distributing insecticides in a fairly satisfactory manner—in fact, without this device, it is doubtful that cotton dusting from airplane, in a uniform and sweeping way, would have been assured the success which has attended six years of effort.

Planes and hangars at the Bureau of Entomology's field station at Tallulah, La.

B. R. Coad, in charge of the Bureau of Entomology field station at Tallulah, La., outlines some of the advantages as well as disadvantages of dusting cotton from airplanes: The flying machine, unlike the one-mule dusting machine and similar ground methods, does not have to postpone operations because of a soggy soil; stumps do not offer the slightest obstacle to the airplane; and the planes can be manipulated so that all portions of a field may be treated without delay. On the other hand, timberlines offer some obstruction to airplane for low-flying dusting, and in the hilly sections of the Cotton Belt it is dangerous to use planes as regular operation. Withal, to quote J. L. Webb, associate entomologist of the United States Department of Agriculture, who has followed the progress of airplane dusting from the beginning: "It is by far the most expeditious means of putting insecticide on cotton. An airplane can accomplish in one day what 100 of the best and most efficient ground machines could accomplish in the same time. Airplane dusting is a permanent agricultural project—it is here to stay!"

The Office of Cereal Investigations, United States Department of Agriculture, in its investigations to determine the distribution of spores, which cause rust to wheat, sought the airplane as the only suitable vehicle for exploring the upper air. The airplane was employed in preference to balloon, kite, or similar device, because the traps to ensnare these minute organisms, when attached to an airplane, could be exposed at varying altitudes and the direction of the flight could be changed at will. An ordinary microscope slide (3 inches by 1 inch), smeared with vaseline on one side, was exposed in three different ways. Of these methods, the mechanical spore trap was satisfactory. This trap had six compartments, each containing a slide. The trap was attached to the wing struts of an airplane and it was provided with a wire control, operated by the observer in the cockpit. One pull on the wire opened the first compartment and exposed slide No. 1; a second pull closed this compartment and terminated the exposure of the slide. This procedure was repeated with respect to the other compartments. This method enabled the scientist to expose one slide at a time, for the desired period, at varying altitudes, and at widely separated points.

On one of the slides, exposed five minutes at an altitude of about two miles

Dusting a field of cotton.

Zooming up at end of field.

near Fort Crook, Nebraska, 244 spores were trapped. On another slide, exposed for the same length of time at an altitude of 8,000 feet, 827 spores of known identity were trapped and about 200 spores unidentified—a total of approximately 1,000. The highest altitude, attained between Waco and San Antonio, Texas, was more than 3 miles, at which height only two spores were identified. "The results of these preliminary experiments," concludes the Bureau of Plant Industry of the Department of Agriculture, "indicate that large numbers of spores and pollen grain are carried several thousand feet above the surface of the earth during the growing season. Probably they are carried long distances by the upper air currents, the direction and velocity of which are quite different from those near the surface. If the spores retain their viability, as some of them quite probably do, it is conceivable that a local epidemic might occur in one locality as a result of the blowing in of spores from an infection center in another distant locality."

And, here again the Department of Agriculture places its stamp of approval on the airplane as a utility device in detecting these minute organisms and thus possibly preventing a disease epidemic among plant life. "The airplane," emphasizes this Government bureau, "is a great aid in studying the distribution of spores of pathogenic fungi. It is likely to be very useful in epidemiology studies and it also may be useful in determining the value of establishing quarantine lines. . . . . Airplanes probably will be useful in studying the dissemination of many pathogenic fungi, and probably will aid in the solution of problems connected with the development of epidemics of plant diseases."

The dusting of Paris green from airplanes to control the breeding of mosquitoes was an innovation introduced five years ago by the Bureau of Entomology, United States Department of Agriculture, in the swamp and marsh areas of Louisiana. A light metal hopper, holding 300 pounds of insecticide, was built in the rear cockpit of the plane and the poisonous dust was released through an opening in the bottom of the fuselage onto the mosquito-infested areas. Similar experiments are now in progress near Quantico, Virginia, the Bureau of Aeronautics of the United States Navy Department using seaplanes for distributing one part of Paris green to one hundred parts of an inert carrier—road dust, for instance. Thus, the airplane is not only offering protection to our potential bread supply and source of cotton cloth but, in destroying mosquitoes by the wholesale, this modern dissipator of distance makes it possible to enjoy our food and clothing supplies with the minimum amount of annoyance from pests that bother.

Loading the dust hopper in a smaller type of duster plane.

Progress on Airways

Cleveland-Albany. Survey work on the Utica-Albany section is about completed and construction work has started on the Cleveland-Buffalo section. Chicago-Twin Cities. Installation of airway lighting facilities on the La Crosse-Twin Cities section has started.

Miami-Atlanta. Construction work on the Jacksonville-Atlanta section is ready to start.

Kansas City-Omaha. Construction work is under way on the St. Joseph-Omaha section.

San Francisco-Seattle. Construction of airway lighting facilities on the Portland-Seattle section is to be begun shortly.

Michigan Airways. Construction work is under way on the South Bend-Kalamazoo section.

Cincinnati-Chicago. Bids were opened recently for construction work, and the award was made to Gustav Hirsch of Columbus, Ohio.

Kansas City-St. Louis. Airway lighting facilities are to be installed on this route.

New York-Montreal. The preliminary survey of the New York-Albany section has been completed and licenses are being secured for the field and beacon sites.

Cleveland-Albany. The Utica-Albany section has been surveyed and practically all sites licensed. This survey is being continued eastward from Utica to Buffalo.

The Salt Lake-Great Falls survey of the Airway is nearing completion. The section from Salt Lake to Malad, Idaho, is the last to be surveyed.

XUM

"Over the Hump

By A. M. Jacobs

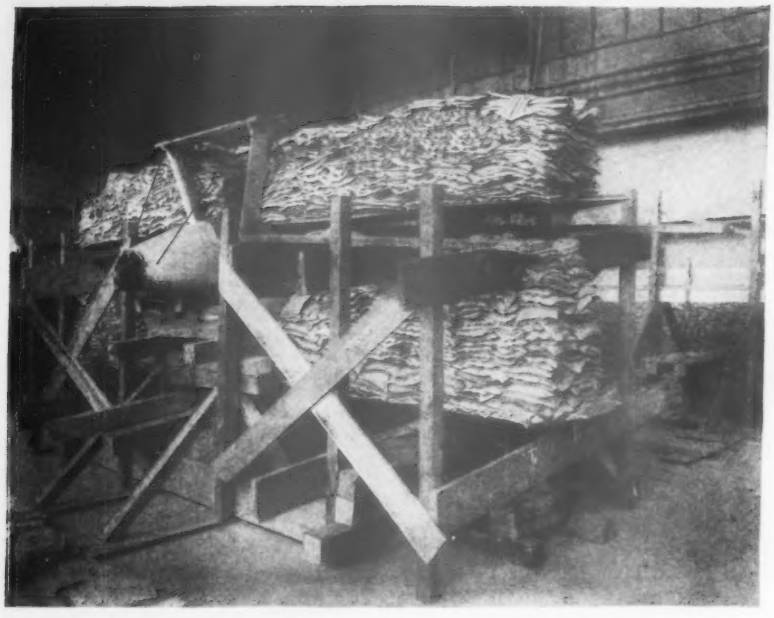
Before the propeller test rig during a water spray test in the winter.

IT is rather remarkable, when one stops to think, how aviation has crept up on us. The years from 1903 to 1914 might be called the period of invention, when man having coaxed wings into the air in power flight was still absorbed in learning exactly how he had done it and what more he could do about it. In the war period, 1914 to 1918, he dared far ahead of his knowledge, making tremendous progress but at terrific cost in life and dollars. The war put aviation into military hands. Fighting was the first practical use which had been found for the airplane. New materials, new motors, new equipment had come forth, undreamed of speed and duration in the air, briefest glimpses of future commercial possibilities. But the growth had been forced, pell-mell.

After the war, Uncle Sam looked upon his new infant prodigy in wonder. No doubt about its tremendous value to him. Willingly he would foster its development and rear up a large family of its fellows about him. But first he must go back to fundamentals and thoroughly understand the elements of its strength and efficiency. Healthful progress could not continue without the orderly foundation of knowledge. This meant research, experimental, and development centers. These had been started during the war and the work carried on in them had been from the first of recognized importance. The Naval Aircraft Factory had operated for the Navy, McCook Field, located at Dayton, Ohio, for the Army. And thereupon was started the period of patient research and testing which more than anything else is accountable for the splendid flying vehicle we have today.

For Uncle Sam merely to secure a new plane in those early days was a complex thing. The war DeHavilland observation planes were already considered poor hacks, needing virtually to be rebuilt to be efficient. The bombers and training planes left much to be desired, while no effective single-seater fighter had been developed for the United States. Desiring to obtain the best and most numerous ideas available for a certain type plane, he would announce a competition, offering a prize to the designer submitting the best model of the type specified. There were not so many airplane manufacturers then, so there was nothing like the influx of models such a competition would produce today from the more than hundred active companies in the United States. The models submitted were small duplicates of full-sized airplanes, built to scale, and finished with the utmost accuracy, each costing from $500-up. The angle at which the wings were set on the fuselage, the curve of the airfoil surfaces, the fuselage itself were as carefully worked out as for the finished plane. Sheafs of blueprints and drawings accompanied them, with every dimension for the full-sized plane minutely set down and with every part accounted for down to the smallest bolt. Besides giving Uncle Sam visual information of the designer's ideas, he could also get an inkling of the flying qualities of the contemplated plane by testing the model in the wind tunnel.

The wind tunnel has been a highly important apparatus in the development of aviation. It was invented by the Wright brothers at a time when they had discovered that the knowledge and scientific beliefs then existing on flying were erroneous and they knew not where



Racing plane undergoing the static test.

to turn for truth. Wilbur was ready to give up, saying that although man would probably fly some day, it certainly would not be in his time. One of them, it is said, tried suspending a tiny wing shape in a stove pipe, putting an electric fan at one end, and studying the action of the wing in the resulting air currents. A less crude tunnel with definite measuring devices was the quick result, and it was by observing the behavior of thousands of these small varied curvatures in the moving air stream that they were finally enabled to build the wings that flew. Today every important air testing laboratory in the world has its wind tunnel.

The McCook Field tunnel — now moved to the new Wright Field—was 96 feet long with an air stream five feet in diameter, moving at a maximum velocity of 275 miles an hour. It is one of the many large ones in existence. An endless variety of model wings, wing sections, aileron and tail surfaces have been tested in it. Measurement of the air forces playing upon each part of the surface is made through wires, too fine to be seen with the naked eye, connecting the model with highly sensitive instruments set under and away from the tunnel. Recently by injecting smoke into the tunnel and using the slow motion picture camera, an attempt was made to get a visual study of the action of the air (smoke) about a certain curvature. Further experiments along these lines will undoubtedly be made. Often from model experiments, a fault has been found in the setting of a tail or aileron surface, and a correction made in the plane design at one per cent of the cost which would have resulted had the change had to be made after completion and flight testing of the airplane itself. Such a change was made from the wind tunnel test of the Barling Bomber tail surfaces. Without that correction, it is doubtful whether this biggest plane in the world would have lifted into the air. Certainly it would not have flown with such unqualified success. With the wind tunnel to help him, Uncle Sam could award the prize to the model which from appearances not only seemed the best, but which promised to fly best as a completed plane.

Sometimes he decided to use a different method of competition, one in which the contestants each submitted a full-sized completed airplane of a type required. When these had been delivered and flight tested, a board of experts would be called from among the Army pilots. After studying and flying each of the planes, a vote would be taken, upon which the prizes would be awarded. The preferred plane would perhaps win $70,000, the least preferred, $35,000, with a corresponding scale for those in between. In this way the winners would get something above the cost of building their planes, the losers would not lose entirely.

Still another method of procurement was used. Army engineers drew up a specification describing what they wanted in a plane, naming its low and high speed, its rate of climb, cruising distance, the number of persons to be accommodated, the engine, and armament, radio, photographic or other equipment to be installed. Questions of design, as to whether the plane would be a monoplane, biplane, or triplane, the type of wings and propeller to be used, all such questions were usually up to the designer. Upon receipt of these specifiations, the manufacturers sent in sealed bids to Uncle Sam, giving their prices for constructing what he wanted. Upon a designated date, these bids were opened, the award of the task being made to the lowest bidder, provided the design he submitted seemed reasonable and his firm reliable.

With construction, the testing process began. Samples of the fabric, metal, wood, rubber, each raw material had to be sent to McCook Field for test and approval before it could be used. As different parts of the plane were completed,

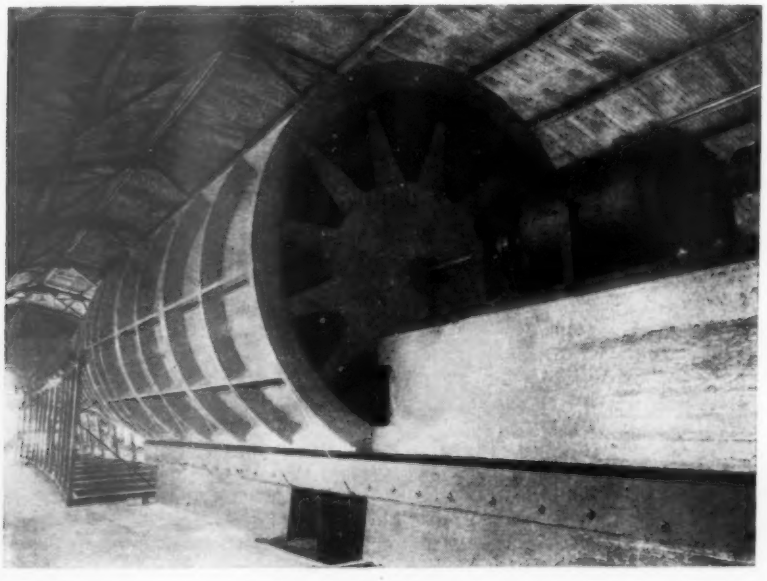
Elevator and stabilizer of a Curtiss S. E. 5 being static tested.

wings, tail groups, landing chassis, or fuselage, they also were sent in for static testing to complete destruction. In static testing, a part was assembled to its fellow parts, as in the complete airplane, and supported at certain points by jigs; then bags filled with shot or sand, weighing two, five, ten, or twenty-five pounds each, or lead bars weighing fifty pounds each, were gradually piled on until failure occurred. In this way the exact degree of load which could be borne by each part was learned.

The air loads to which an airplane was subjected in the different attitudes of flight were even in those days fairly well known, though not so definitely as now. Each part must be able to bear this specified load and a designated margin over for a "safety factor." As the bags were added, and the weight of the required load factor was approached, the engineers studied the effect on the part. If it showed weakness, or bent, or broke, it was rejected, and the manufacturer had to design a stronger part, to be sent in later for the same testing. If the part showed no strain under the required load plus its safety factor, the bags were still piled on, five or ten pounds at a time, until it failed anyway, and thus its full strength value was definitely learned. A slightly higher strength value than that required was not considered an objection. But a strength greatly in excess of that required was as sure a cause for rejection as lack of sufficient strength.

That seems almost like condemning an article for being too good. But there was logic behind it. Probably one of the phrases most hackneyed among aviation engineers is that of "the strength-weight ratio." From the first airplane their problem has ever been to get a required strength at a minimum weight. An airplane is a thing of such careful design, such nice balance. A part that is overstrong invariably weighs more than has been planned for in the design. If this over-weight is allowed to enter in, it means either that the plane will have a higher take-off and landing speed and less maneuverability in the air, or that the amount of fuel or equipment or the number of persons to be carried must be reduced. Hence if a lighter, less strong part can be used and the proper strength-weight ratio be maintained, that less-strong part is invariably demanded.

Scale models of airplanes and airfoil surfaces used in wind tunnel tests.



Rear view of five foot wind tunnel, showing one motor.

Landing gears, wheels, axles, tail skids, and fuselages always underwent a second type of testing in the big static test laboratory. This was "dynamic" testing, which signifies "active" testing as distinguished from "static" testing, in which the part remains stationary until failure. Dynamic testing is also often referred to as "drop" testing. Supposing an axle were under dynamic test, wheels with tires were assembled to it, it was installed on a skeleton fuselage and loaded with sand or shot bags to equal the weight of oil, gasoline, engines, persons, and equipment the completed plane was designed to fly. This assembly was suspended a certain height above the ground from a twenty-foot scaffold, which because of its heavy dangling chains and the block which dropped upon release was popularly called the "guillotine."

When the great chains released the block, the weighted skeleton fuselage with its landing gear dropped to the ground. The height of the drop was figured mathematically to give the same shock or jar to the assembly that the completed plane would receive on impact with the ground upon landing. Weakening or failure of any part of the assembly was cause for rejection.

Throughout these tests, Uncle Sam's engineers worked in closest cooperation

Capt. A. N. Stevens, observer (left), and Capt. St. Clair Street, pilot (right), about to take off for photographic altitude test. Capt. Stevens holds a small electric heater across his finger tips.

with the manufacturer, suggesting, planning, inventing, to get the thing they both wanted. Up to 1922, not only the parts but the whole first airplane to be delivered on an order was static tested to destruction. It was an expensive procedure which by 1922 had yielded such a rich harvest of knowledge that this extreme course was no longer considered necessary. Up to today, however, no part whose characteristics are not thoroughly known is excused from the wind tunnel, static and dynamic test trials.

The value of this patient, thorough, conscientious test work, this checking and analyzing of thousands of materials and structures cannot possibly be exaggerated. Together with the intensive system of flight testing of completed planes in force by the government, it has laid the foundation of basic information concerning the strength of materials and structures, the efficiency of various methods of design which, after the war, Uncle Sam hoped to establish.

Engines, propellers, and equipment have leaped forward under the same system of thoroughness. At McCook Field, Uncle Sam had the largest propeller test rig in the world. The new one being erected at Wright Field, which is replacing old McCook, will revolve even larger propellers and at higher speeds. Likewise a bigger, more modern engine dynamometer is nearing completion at the new location. Among its first tasks will be the testing of an "X" form, twenty-four cylinder, air-cooled engine, which it is expected will deliver 1200 horsepower. This is the greatest amount of power ever asked of a single aviation engine and if it proves successful, the type of plane possible of design about one or more like it, makes interesting contemplation.

Even after the intensive course of testing followed, up until two or three years ago, when a new plane had been assembled and wheeled out of the hangar, its engine set going, and the test pilot, whose name had been drawn from a hat for this first test flight, had "given 'er the gun," there was no real surety that it would fly. Sometimes it settled back and refused to lift, or was nose-heavy and came crashing down, or wasn't balanced properly, or refused to answer smoothly to the controls.

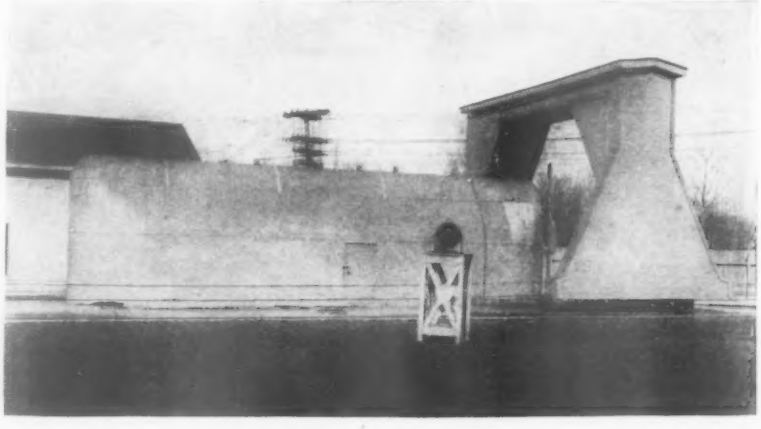
There was always a sense of excitement over this first try-out. Every engineer, flyer, inspector managed to be on the field for it. The manufacturer and his chief engineer often came great distances to witness it. As a first step, the pilot usually taxied to the far end of the field and turned the new plane into the wind. The engine was then speeded up—but not to flying speed—and the tail lifted so that the plane skimmed along the ground on the wheels. After covering the field several times in this fashion, the speed was gradually increased and the plane hopped at about three feet above the ground for a short distance, then brought down; then the height increased to about six feet. The pilot was trying out the controls, getting the flying "feel" of the great new bird. Usually that ended the first try-out, for faults showed up which had to be corrected before it could safely be taken higher. Sometimes the faults proved of such insidious character, that they could not be corrected and the plane was never flown.

Perhaps, if the pilot found all favorable, the engine would suddenly be set roaring at full throttle and those watching would see increased speed, the tail lifting, the nose headed upward, the plane banking over the hangar roofs, and soaring off into the blue. There will never cease to be a thrill to that first, clean, powerful, upward thrust of a new plane. In it man captures an echo of the joy that must have come with the turning of the first trick of flight. Especially does this thrill belong to those who have had a hand in its making.

Today, unless it is of radical design, this uncertainty as to whether a new plane will lift in flight scarcely exists. Principles of aerodynamics, the materials and structures of aviation, have become sufficiently standardized in the last three years to insure this result with a fair degree of certainty. Emphasis instead

(*Continued on page* 97)

Biggest propeller test rig in the world, with propeller mounted for testing.



Whether or Not to Know Weather

By M. Luckiesh
Lighting Research Laboratory, National Lamp Works of General Electric Company

INASMUCH as weather is so obviously associated with the sky, it is not strange that the earliest writings contain many observations of winds, clouds, rain, cold and other common factors of weather. Even the most primitive of early beings could not escape noticing certain sequences or relationships of these. Naturally, these primitive observations resulted in a sort of weather lore found in the oldest books of the Bible. Some of these simplest relationships of the elements, as presented in early writings, are sound even today. However, in general, they reflect as all thoughts and conclusions always do, the state of knowledge of the time and the degree of intellectual development of the individual.

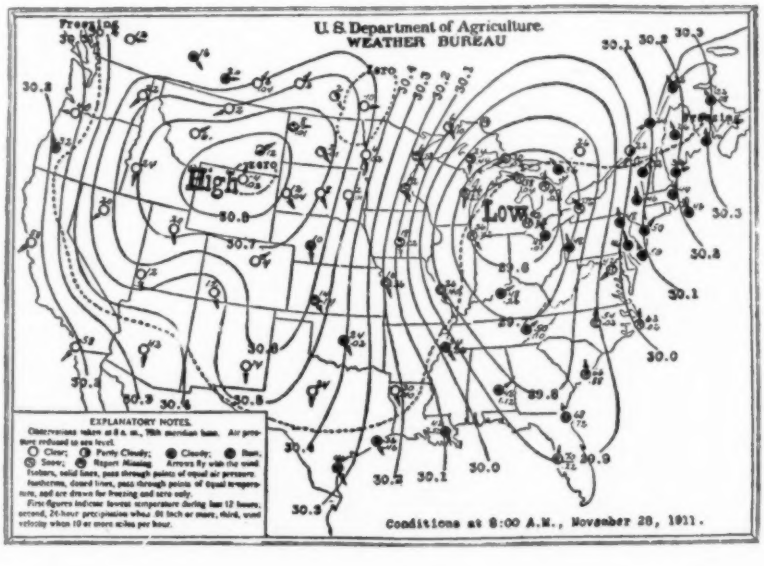
To the ancient Greeks, whose civilization reached its peak a few centuries before the Christian era, we owe the word "meteorology." It means the science of "the things above." At the time this word originated, the Greeks were interested more in the study of meteors and other apparently disorderly celestial travelers, such as comets. They had formed no clear conception of the atmosphere. They had vague theories born more of philosophy with an appreciable remnant of mythology than of accurate knowledge. Even Aristotle, one of the greatest geniuses of all time, had a weird conception of the atmosphere. He divided it into three regions. One was the lowest region where plants and animals lived. The intermediate space was one of intense cold. The outer region was that of fire and the heavens. He thought that comets and meteors were vapors ascending from the earth which became heated to incandescence in this outer region. Imagination was substituted when there was a lack of data from actual observations.

Nevertheless, Aristotle's treatise on winds is the oldest in existence and for two thousand years little was added to it. In Athens these ancient Greeks built the Tower of the Winds. It was eight-sided and, therefore, the eight principal points of the compass were represented. On each face a human figure was carved and its expression, action and clothing represented the character of the wind from each point respectively. For two thousand years mankind accepted the philosophies of Aristotle and others, and those not thoroughly satisfied, philosophized to their own liking. Modern science is based primarily upon fact-finding—upon experimenting. In the seventeenth century there was a definite turning point—the long age of philosophizing began to give way to a new age of experimenting. This battleground extended over the entire civilized world and the battle still goes on but with diminishing force as mankind has learned more and more to accept facts as the foundation for beliefs.

The experimental stage could not develop without instruments so that three centuries ago when the modern science of meteorology began, a great impetus was given to the invention and improvement of the necessary devices for making observations. Now we have many kinds of instruments for indicating and even for recording temperature, pressure, wind direction, wind velocity, cloudiness, precipitation, sunshine, humidity, and many other factors. These are indeed the "elements" instead of merely rain, snow, wind, and cold, as commonly considered.

Oddly enough, the word meteorology which was derived from a Greek word meaning "the things above" is now of great interest to us owing to new "things above"—aircraft. The term meteorology is one of those misfits well entrenched in scientific usage which makes us smile with some amusement at exacting science continuing to use poorly fitted and even inaccurate terms. Nevertheless, we have this term now meaning the phenomena of the atmosphere. This science is really a branch of physics, for meteorology is in reality based solely upon the laws of physics. To understand all the intricacies one needs only to know physics. To prognosticate weather, however, one needs only to know the meanings of the relationships of the elements. Experience based upon many observations is relied upon to predict what the future will be. The past and present weather are forerunners of the weather of the immediate future.

Before the invention of the telegraph, weather forecasting was quite a local matter. It could be relied upon only a short time ahead. Now every civilized country has many meteorological stations from each of which daily and sometimes hourly reports are made. As a consequence, we have a daily picture in this country of the weather conditions over the entire region. Radio has added to



Daily Weather Bureau chart. Barometric "highs" and "lows," wind direction and cloudiness and precipitation are recorded.

the certainty of weather forecasting. It told the Graf Zeppelin on its recent 6000-mile trip that the northern Atlantic was being lashed by storms.

With this long-distance reporting from many stations, weather forecasting has been replaced by a knowledge of what the weather actually is here and there. The aerial traveler who is meteorologically wise has this picture before him and he can steer his course to avoid the usual path of the storm-center. Weather forecasting, with the exception of purely local disturbances such as tornadoes and thunderstorms of small area is now a prediction that known weather at a distance will follow its usual path. As a consequence, the weather bureau is now always correct unless some unknown or unforeseen factor interferes. Notwithstanding the facetious banter hurled at the local forecaster of the weather bureau he is nearly always correct—if he is skilled and familiar with the locality—and when he is wrong it is because the storm-center or the sequence of elements did not proceed as it usually does.

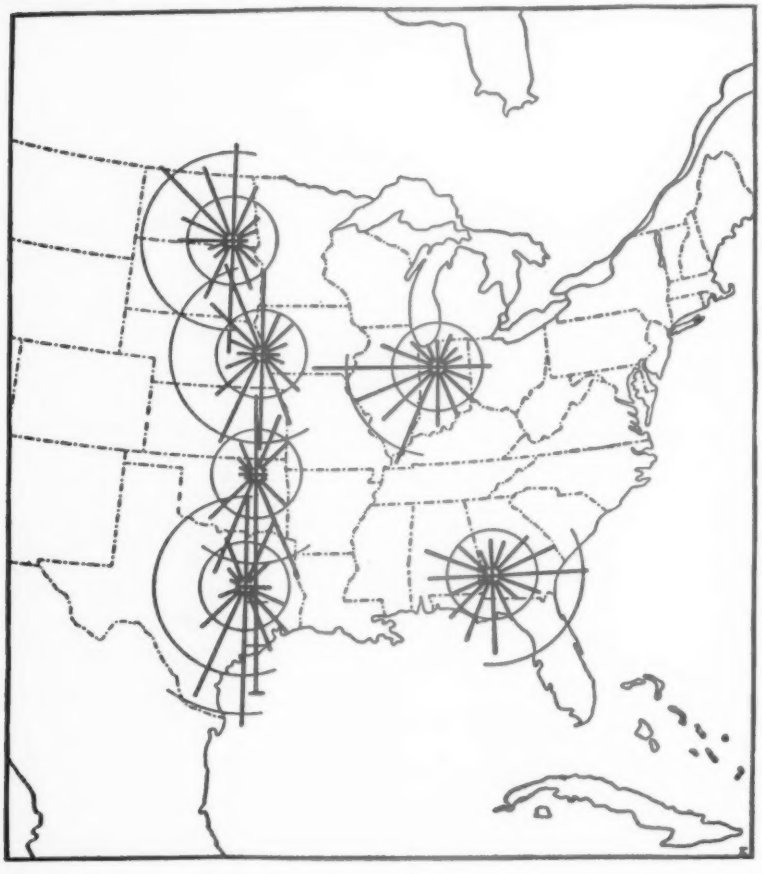
From the continuous observations made at meteorological stations we have an unbroken record of weather which changes both systematically and in haphazard manner. From these data averages are computed of temperature, windiness, sunshine, etc. These averages give us a true picture of climate. Thus, climate is a matter of average weather for periods of such duration as to be the most convenient and enlightening.

Those interested in aviation are of course always interested in the weather—relatively rarely in climate. And they are chiefly interested in the weather of the immediate future. They need not bother about the weather of the present because that is obvious to anyone with enough sense to come in out of the rain. But there is an even more general and far-reaching reason for being interested in meteorology. Certainly it increases the interest of flying to know something of the many details of the atmospheric ocean in which one travels. Knowledge is always useful no matter how long it is stored. Who can say when it may increase resourcefulness or determine judgment which may avert disaster? And then come the clouds. Surely a knowledge of their meanings so increases intimacy with them that their supreme splendors, their magnificent proportions, and the endless variety of their forms and colorings are so much more impressive. Certainly among "the things above," of which meteorology treats, the clouds are most useful as well as beautiful and sometimes awesome sign-posts on the highways of the winds. Preceding articles have dealt with both the facts and the fancies of clouds and other "things above." In the present article we are pausing for reflection and inquiry into the science as a whole. In the future, further glimpses of clouds and other phenomena will be given.

To most persons with casual knowledge or interest in weather, perhaps winds and clouds would seem of most importance. However, temperature is perhaps the most fundamentally important element of meteorology; not because the weather may be too hot or too cold to suit us but because all winds or air currents are due to temperature differences. Weather is a consequence of the circulation of the atmosphere. Without such movements we would have a constant condition—no weather in a sense. Air which is warmer than the surrounding air is lighter and as a consequence it rises. It cools by expansion and some of the moisture or water-vapor which it contains at the lower altitude condenses as the air cools by expansion on rising. Thus clouds are formed. In such a manner the great cyclonic storms originate. The ocean breeze is borne in the daytime because it comes in from the sea to replace the warm air over the land which rises because it is lighter. Similarly, all movements of air are due directly or indirectly to temperature difference. The measurement of this element is a commonplace experience with all of us.

The most universally useful measurement for weather prediction is that of atmospheric pressure. Is there any reader of this who has not been additionally thrilled by increased suspense while reading a story of the sea when he came to the point where the captain seriously noted the rapidly falling barometer? A storm was approaching and the rapidity of the fall of the barometer foretold the intensity of the winds to be expected. A very rapid fall into unusually low pressures was the evil portent of a hurricane. Sails were furled and the coming fury was awaited grimly. All interested in flying know that the altimeter is nothing more nor less than an aneroid barometer.

Now that atmospheric pressure is a fact of common knowledge and of easy measurement it is difficult to believe that even Galileo, who died in 1642 and who was one of the great geniuses of the beginning of the age of experimental science, did not know why water rose in a pump. Neither he nor anyone before him knew the significance or result of a vacuum or of atmospheric pressure. He did not know that on pumping out the air



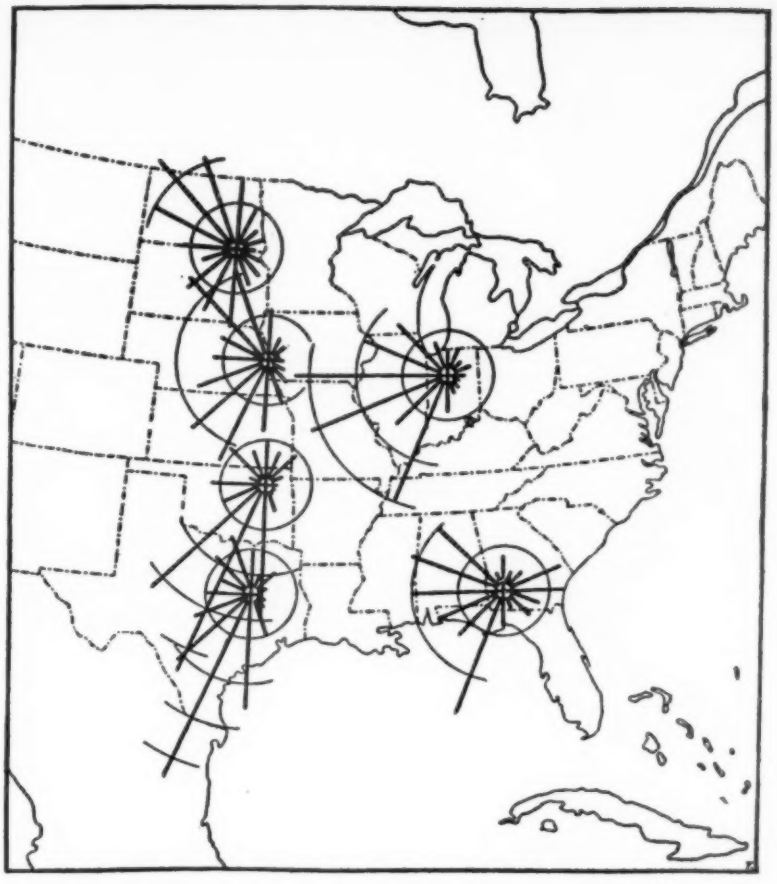
Annual average frequency of winds from different directions at the surface of the earth. The length of each black line indicates the relative frequency in that direction, toward the center.

in a vertical pipe the atmospheric pressure was eliminated on that side and that this pressure on the surface of the water in which the pipe hung forced the water up the pipe. Of course, the water rises until the pressure is the same above and below. In the case of a perfect vacuum above, the water will rise until the weight of the column is about 14.7 pounds for each vertical element one square inch in cross-section. In other words, the atmosphere exerts a pressure of nearly fifteen pounds per square inch. Thus the normal atmospheric pressure at sea-level will support a column of water about 34 feet high. This is a barometer, for, as the pressure varies, the height of the column of water varies.

It remained for Galileo's pupil, Torricelli, a year after his teacher's death, to find out why the water rose in a pump and to invent the mercury barometer. Mercury is 13.6 times as heavy as water. Therefore, the normal atmosphere will support a column of mercury at sea-level only about 31 inches high. This made a barometer of practicable size. As a consequence "inches of mercury" became the measure of atmospheric pressure and owing to the variation in the height of the mercury column the barometer was said to be rising or falling. But even this instrument is not readily portable so the aneroid was invented. This consists of a series of evacuated drums of thin metal which are kept from collapsing by means of a spring. The variations in atmospheric pressure are indicated by greater or less compression of the drums. This movement is transmitted to a pointer and we have an instrument whose scale may be in inches of mercury or altitude in feet.

When used in one location the barometer registers true readings of the change in atmospheric pressure. However, when the instrument is carried to another location it merely gives the relation of the pressure at this place to that of the starting place. Therefore, in airplane travel the altimeter cannot be relied upon strictly for weather prediction because one does not have a reading of the pressure at the new location some time before. Furthermore, the aneroid barometer is somewhat sluggish so that the extent of a rapid rise or descent of the airplane is not truly indicated for an appreciable time. This must be taken into account when, flying in a fog or in darkness, the ground is not discernible.

Weather maps give a picture of the position of barometric "lows" and "highs" —cyclones and anticyclones respectively. A comparison of them for successive days shows the progress of these general storms across the country. Observation has shown that they follow fairly definite paths which are in a general direction from west to east in this country for the ost part. However, this does not mean



Annual average frequency of winds from different directions at an altitude of about one mile. There is a pronounced shift toward general westerly winds as the altitude increases.

that they do not travel in directions far from a west-east line. It means that in general they have a resultant easterly movement notwithstanding their actual direction of travel. For the flyer and anyone else a real weather-eye will look to the barometer regularly and often. Beginning with this and combining general knowledge of clouds, winds, humidity, and direction of travel of cyclonic storms, one is able to become a fair weather-prophet which is always an interesting diversion and often a useful accomplishment. One will save himself many times from an embarrassing or at least annoying weather surprise. A recording instrument—a barograph—is still more useful than an indicating barometer. With this, one has a continuous record for some time past. Such an instrument is sealed and carried on altitude flights for which proper credit is expected if a record flight is achieved.

Meteorology consists of periodic changes of various elements and also those which are irregular or non-periodic. Temperature rises and falls during the day. On a cloudless day this is a very regular curve, but of course clouds cause irregularities. In the same manner there is an annual variation but its regularity is only seen on taking averages, owing to the many non-periodic elements. There is a well-known twelve-hour barometric oscillation in equatorial regions which is often so regular that the time of day can be read by means of the barometer. Certain winds are periodic, daily or yearly, and in some cases fog, clouds and duration of sunshine are of such regularity. In the science of meteorology one of the first steps in unraveling the great complexity is to separate the periodic from the non-periodic elements. However, there are so many variables that meteorology is almost always a combination of these two types of variables. After a meteorological element has been observed for some time it often becomes necessary to summarize the results obtained and for this purpose four values are determined—maximum, minimum, mean and departure from the mean. All this has enabled the forecaster to increase the accuracy of forecasting and the length of time into the future which he can safely foretell. Perhaps eventually knowledge will enable him to predict weeks or even months

ahead but now with telegraphic reports from all over the country and even from other countries it is not possible to predict more than a week ahead. Great certainty is confined only to a few days at most. Therefore, the almanacs which are still sold widely with a year's weather predictions are perfectly useless. Still, great numbers are sold to the gullible or uninformed public.

The composition of the atmosphere is practically constant in the lower region where convection currents are found. These are the vertical currents due to the rise of the warm air which is lighter than the air above. The composition is nearly constant owing to this stirring of the gases of which the air is composed. These convection currents occur where there are temperature differences vertically, that is, a vertical temperature gradient. In the temperate zone this is a region up to seven miles and in the equatorial zone up to about eleven miles. Nitrogen normally comprises about 78 percent of the volume of the atmosphere in this lower layer and oxygen accounts for about 21 percent. The remaining one percent consists of argon, carbon-dioxide, hydrogen, neon, and helium. These gases differ widely in density so that if the atmosphere were not stirred by vertical convection currents, or if it were quiescent as it would be if there were no temperature differences, the heaviest gas would settle to the bottom. Near the surface of the earth, oxygen would be found with some of the rare gases at the surface. Above the oxygen the nitrogen layer would exist. Under such conditions, life would not exist because there would be no rain—no change. Consequently, it is fruitless to speculate on this change in atmosphere to almost pure oxygen near the earth's surface.

Annual average frequency of winds from different directions at an altitude of about two miles. Winds at this altitude are mainly from west to east.

There are two variable constituents in the atmosphere which are important—water-vapor and solid particles. Water-vapor is invisible but when condensed into water particles it is fog or cloud. Water-vapor must have nuclei or actual material particles to condense upon. Therefore, at the center of each droplet is found a gaseous or dust particle. Of course, dust (smoke and other solid matter) reduces visibility for it is chiefly responsible for the well-known haze. However, it compensates for this evil by being largely responsible for twilight and for the colors at sunrise and at sunset.

Water-vapor is present in the atmosphere in exceedingly small amounts, considering its overwhelming importance. It never exceeds four percent even in tropical regions and in temperate latitudes it scarcely ever exceeds one percent. It is confined entirely to the lower region of the atmosphere as is indicated by the height of clouds which seldom exceed seven miles in altitude excepting in tropical regions where they are sometimes higher. It is a fact of common observation that, excepting the towering thunderheads which are the result of unusually powerful vertical currents, the higher the clouds the thinner they are. Most of this small amount of water-vapor is within a mile or so of the earth's surface. It gets into the atmosphere by evaporation from rivers, lakes, oceans, and the moist surface of the earth. Just as temperature difference is the fundamental meteorological element of prime importance so is water-vapor the constituent of the atmosphere most influential upon weather and particularly climate. Of course, we need oxygen to breathe but the oxygen would be of no use if it were not for water-vapor which makes all life—plant and animal—possible. All the phenomena of clouds, rain, dew, hail, snow, and frost are due to it. The rainbow, the halos about the sun and moon are caused by it. The study of water-vapor and its results forms a large part of meteorology.

Air at a given temperature and pressure can contain only a certain amount of water-vapor. When it has all it can hold, the relative humidity is 100. When the relative humidity is lower the air can still hold more water-vapor. The lower the relative humidity the thirstier is the air. Over the arid deserts the humidity is very low. When the air is humid we notice the heat because the perspiration from our bodies does not evaporate readily. The evaporation is what helps to keep us cool because it takes considerable heat to convert water into its gaseous state—water-vapor. This heat is taken from us when perspiration evaporates and we are cooled by so much loss of heat.

Absolute humidity is a measure of the actual amount of water-vapor in a given amount of air. Relative humidity is merely the ratio of the water-vapor in the air to the total amount the air can hold. In other words, it is the percentage of the total amount containable by the air under the given condition of temperature and pressure. If the air is saturated—containing all it can hold—any decrease in temperature or in pressure will cause some of it to condense. Thus we have dew or frost or fog or cloud

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The Airport—A Civic Investment

By Milo F. Kent

A LONG gray monoplane sliding down through the drizzle of a December twilight, a landing, a minute's taxying up to the passenger station, a covered runway rolling out on its little track; laughing, chattering passengers stepping down from the cabin and walking comfortably up to the station or along a covered passageway to the hotel whose lights are shining through the rain —you can see it all at any of several American airports. Omit the hotel, or substitute for it a restaurant, and you can increase the number materially, for hotel accommodations for passengers appear to be about the last improvement we add to our air terminal facilities.

A year ago there was nothing like this in the United States. Two years ago most people, the authorities included, believed an airport consisted merely of a landing field and hangars—and that was the total of the facilities at most of them. Even such as they were, the ports were all too few in number. Indeed, though we had a score or so of good landing fields, until the letting of the air mail contracts put aviation on a business basis our real airport facilities were composed solely of military or naval air bases with perhaps one or two well-developed private fields. Since then the public has realized something of the airplane's importance as a means of transport and has been apprised, at least in part, of the function ground facilities perform in connection with flight.

Antony H. G. Fokker declares that "aviation is 90 percent ground and only 10 percent flying." We have ignored the ninety in favor of the ten. When the Wrights pointed the way into the sky for us we were all at once so occupied with the marvel of flight that we neglected doing the things on the ground which would make flying most useful, most convenient and most simple for us all. But now we are beginning to mend our ways.

It is a dull month, now, which does not see 70 or more landing field or airport projects announced. We have even reached the point where wealthy men are establishing their own fields for private use. We have aviation country clubs which are establishing fields and hangars and clubhouses for their members. The advance has been remarkable and, provided we do so without remission of effort for further improvement, we are entitled to point with justifiable pride toward what has been accomplished.

Ever since we had military aircraft we have had military landing fields. Ever since the early operators conceived the idea of making money by training student pilots or taking the venturesome for rides through the air we have likewise had private ports of a sort. The stereotyped expression of the old-time "barnstorm" flyer was, "I went into town and opened an airport." But the real development of airports in this country dates from the beginning of the transcontinental air mail service in 1919.

At that time postoffice officials went along the line of the proposed air route and urged the cities to set aside designated areas as landing fields and to provide funds for erecting hangars. Lacking authority to expend public money for such purposes, the communities generally rolled this burden onto the shoulders of their more public-spirited citizens or met the exigency by arranging for use of existing military fields. At all events, the fields were provided.

Mr. Kent is chairman of the airport committee of the board of supervisors of San Francisco. It was almost entirely due to him that San Francisco created Mills Field, and he was the leader in the recent campaign for the passage of a $1,700,000 bond issue for improving San Francisco's port.

Then in 1926 came the private air mail contract lines and suddenly there was a demand for scores of fields, some of which had to be created entire and some of which could be provided by expansions or improvements. The experience which had been slowly piling up during the years of the transcontinental route's operation was called upon and we did what all must admit was a first-class job as far as it went. We provided the fields and we did it on time.

Sometimes the ground was bought; sometimes it was leased; sometimes we arranged for use of fairgrounds or other spaces already owned by the community; in not a few cases we shouldered the load onto our chambers of commerce, which rented the necessary acreage wherever it it could be had. Buildings were scraped up somehow—new frame structures, old warehouses, in one case an old motion picture studio was moved to the flying field for a hangar. The facilities were meager but served their turn. More recently our air mail has grown and our air passenger business has expanded so that we have found it necessary to install new facilities, to improve our methods of handling mail and to install a great number of conveniences for passengers. We have also had to do something for the great numbers of sight-seers who visit the ports.

In these latter respects we have borrowed a good deal from Europe, where the carrying of passengers, aided by government subsidy, has been an active enterprise since war-time days. We no longer consider a given field an airport unless it has adequate housing for planes, facilities for their repair and servicing, lights for night flying, complete weather reports, ample communication facilities and some provision, at least, for the comfort of visitors and passengers. Generally we demand a restaurant and we are beginning to think "hotel" whenever we think "airport."

We are also beginning to regard our ports as places of public recreation. At least one new port is being equipped with a dance floor and an outdoor cafe whence patrons can watch the flying. We are also paying more and more attention to beautifying our ports with shrubbery and parking.

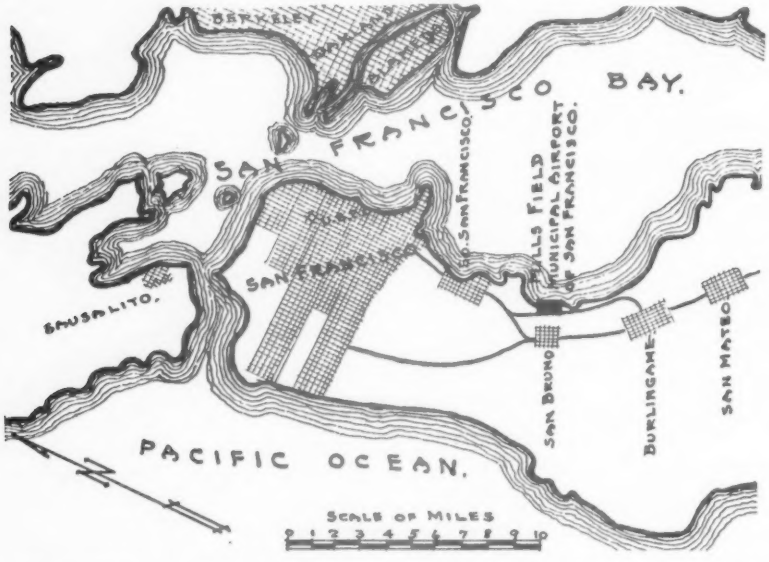
Of course such elaborate establishments are quite beyond the reach of the small community and no reasonable person expects them to be provided by the country town or the budding city. What is asked in such cases is adequate space for safe landings and take-offs, protection against the weather and servicing facilities.

Yet many communities, unable to appreciate the importance of creating some sort of a harbor which will give them contact with this new channel of communication, are unwilling to do even this much.

Risking the accusations of heresy which will probably result, I am going to say that this is a desirable and even

a necessary condition. If all the cities which eventually will have airports should attempt to build them now, simultaneously, the strain on the manufacturers and purveyors of hangars, lighting equipment, drain pipe, fencing and the like would be more than they could withstand. Prices would go up and we all would have to pay more than we should for things which at best are costly enough.

By advancing as we are, establishing a few new airports each month, we keep business going at an even rate and enable manufacturers to build up plants which will be of value to all of us from time to time as we make the inevitable improvements in our ports. I cannot be dissatisfied with a progress which adds 698 landing field projects, many of them



The map shows the location of Mills Field, Municipal Airport of San Francisco, in relation to the city.

well worthy of the name "airport," to our aviation aids within a year.

This progress will probably be even more rapid for the next few years, until the air mail routes are nearly all established, the airways have become as definitely fixed as our highways are today and our cities and towns are nearly all provided with airports. After that the main work will be improvement.

The department of commerce figures as of August 15, the latest compilation, indicate that there are in the United States 367 municipal landing fields, 351 commercial or private fields, 62 army and 17 navy air establishments, plus 256 intermediate fields marked by the department of commerce and 326 marked auxiliary fields scattered along various airways. Proposed new fields, mostly municipal, number 698. Excluding the intermediate and auxiliary fields, not used for commercial operations, and the military establishments, we thus have one field for each eight licensed or identified aircraft. However, as there still are a number of aircraft in the country which are not registered with the federal authorities, a conservative estimate would be eleven airplanes to each field. This number is being increased rapidly, as production of commercial aircraft is in excess of 100 planes a week.

The actual number of planes making headquarters at a given field varies widely. The average at the larger ones, those which properly merit the name of airport, is probably 50 or more. Here on the Pacific coast, where we have a great number of fields within comparatively limited areas, several fields regularly house that number. At Chicago, Cleveland and some other aviation centers the number must be much greater, though no actual count was made. On the other hand, many a private field owner who asserts he is making money has no more than two or three ships in his hangars. However, in this case, the field is an adjunct to aerial operations from which the profit is derived and is not of itself a producer of any considerable revenue, as are the large municipal or commercial ports.

It is obviously at the municipal ports, where many air operators make their headquarters, that the greatest numbers of planes will be concentrated and the greatest expenditures demanded and justified in future. Even today it is almost entirely among these establishments that we find what may justly be called "airports" as distinguished from mere landing fields, for very few private operators can afford to make the investment necessary for a real airport. Not even Mr. Ford has yet set up at his Dearborn field all the facilities which go to make a true airport.

Yet cities can afford to spend, and are spending, a million, or two, or five, to create an airport as a means of attracting air travel and encouraging aviation industries. They can afford to prepare for the future. They have an enormous advantage over the private operator in that they pay no taxes, can borrow at a lower rate than he and generally have great credit.

A great many cities have already made substantial investments in air terminal facilities. Most of them have been ready to make improvements as the demands upon their ports increased. It is a peculiarity of airport finance that the cost of the plant does not increase proportionately to the number of ships handled. The first cost is the heavy cost; it is possible to create near almost any large city an airport capable of caring for a hundred planes a day at less than double the cost of the acreage necessary for one plane to land.

Purchase of the site is the largest item in the cost of a completed airport to serve a large city, though often the smallest where small communities are concerned and congestion has not yet forced ground-values upward. Next may come either buildings or filling and drainage, according to the nature of the ground, with surfacing and lighting bringing up the rear. Occasionally, where great areas of surfaced runways are constructed, the cost of surfacing may exceed that of building, but in such instances drainage is usually a minor item.

There are airport areas which cost as little as $7 an acre, as was the case with a part of the Salt Lake City site, and others as much as $20,000 an acre, such being the value placed on Swan Island, occupied by the airport of the Port of Portland, Oregon.

Cost is pretty accurately determined by location and by density of population. It is my opinion that our ports are located nowhere near the best points for service of our large cities. Practically all of them are too far out from the business centers they serve. There is no city which to my knowledge has an air terminal as conveniently placed as its railroad station. Today we pay excess postage or heavy passenger rates to save time, yet squander five to twenty-five percent of our saving in our ground connections. Economic pressure will put an end to this by and by, when air travel is heavier, if, indeed, awakening public consciousness of air transportation's value does not force a change sooner. While we may never be able to devote great areas in the heart of our cities to aviation terminals, we can work out some plan of small fields, close in, with housing and servic-

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ing facilities at some point where land values are lower.

Chicago is in a fair way to solve the problem with its projected lakefront airport, which will be just such a station for planes to load and unload. In fact, for convenience and accessibility this approaches the ideal and though the cost will be heavy, the city will enjoy in return as good service as any in the world.

Other cities, lacking a waterfront to be filled in, may solve the situation by erecting landing platforms above the large, comparatively low, buildings of their industrial areas. Or decks above the railroad yards may be the answer. The scheme is sound enough from an engineering standpoint and can surely be financed from a very reasonable landing fee within a few years if air travel does even half what is expected of it in the way of growth.

As far as existing facilities go, the airport at Boise, Idaho, is more conveniently located than any other, I believe. This is just a mile and a half from the postoffice. San Diego's new Lindbergh Field will be half a mile closer in. Among large cities, Kansas City holds the palm, with a port only six minutes by motor from the business center. Portland, Oregon, is nearly as well off.

However, the time is nearing when no large city will be satisfied with the service available through any one airport, no matter how well located. Others, located conveniently to various sections of the metropolitan area, will be necessary.

Air transportation itself will pay for these. Many ports less than two years old are paying their operating costs; some have reached that point in their first six months. Soon the revenue will be enough to carry interest charges on capital invested.

These revenues accrue through rental of ground and hangar space, landing fees, gasoline, oil, hotel and restaurant concessions, special charges for use of night landing lights and the like. Some older ports, especially along the transcontinental route, receive very little revenue because when they were established all sorts of concessions were made merely to insure that the city would be designated as a stop on the air mail route. Nominal leases made then have several years to run, in some instances, and consequently the more intensive developments are to be found at the newer ports, created after aviation became able to pay for services rendered.

For small cities, adequate lighting is often only as costly as the building program conditions justify, surfacing is a small item and drainage negligible. Here are some typical figures covering a small city's field, the airport of a city of 350,000 persons and the port, now under construction, of a city of 1,000,000:

	Small City	Medium City	Large City
Distance from postoffice	2 miles	12 miles	18 miles
Acreage cost, per acre	$400	$590	$3,250
Drainage	——	$70,000	to be done
Grading and surfacing	trivial	$40,000	$30,000
Buildings	$6,000	$275,400	none as yet
Number of planes can house	three	135	

However, the saving in time made possible by opening the city to air communication, the greater public convenience, the industries attracted and the gains in population attributable to the aviation activity seem to justify civic authorities in waiting a little longer before they seek to make the industry carry all its own charges. The interest on $1,000,000, the cost of ground for a fair airport in a moderately large city, is only $40,000 a year or so and it is a small port, indeed, which does not bring into the community enough new taxable wealth to produce that sum. What the authorities spend with one hand, therefore, they regain with the other.

While this situation prevails with publicly-owned ports, it does not do so with private enterprises. This may be construed as an argument in favor of publicly-owned ports during the present stage of aviation development, and it is a fact that cities have been able to find the money for airport financing more readily than individuals.

Lack of precedent has caused some peculiar methods to be employed in this financing. Expenditures amounting to millions of dollars have been made on assumptions or legal fictions which had not borne the test of judicial decision. Three principal methods have been developed for legalizing the expenditures necessary to establish airports. One is to assume that the air terminal is a part of the port facilities just as are the docks which serve as terminals for water-borne commerce. This was developed by the maritime cities of the west coast and finds notable examples at Portland, Oregon, and Oakland, California, where port funds financed the development.*

The second is to assume that the port is part of the park facilities—which it patently is not, though apparently no one has been found to challenge the assumption. This method of financing is found, with variations, at such points as Chicago, Salt Lake City, Boise and Santa Monica. The third method is to ask the public outright to vote bonds for an airport, without attempting to define it as a terminal, a harbor facility or anything. This has been employed at Detroit, at my own city of San Francisco and in other places. It appears to give the soundest legal foundation of any plan.

What we really need is legislation authorizing the municipalities to spend money for airports as they now have power to spend it for streets, bridges, harbor improvements, water works or other facilities for the public service.

Of course we have now reached the point where the business of establishing and operating airports is beginning to attract private capital, much on the same basis that private marine terminals are financed. That this means municipalities should step out I do not believe. Few cities would be willing to relinquish their harbor development to private enterprise, yet few discourage establishment of private marine terminals. I anticipate a somewhat parallel development of air transport aids—public owned air-

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Spreading and packing earth on Mills Field with motor truck and caterpillar tractor.

The Flying Laboratory

By Armstrong Perry

A UNIQUE effort to solve the many problems of airplane radio is being made by M. B. Sleeper, a research engineer whose name is well known to radio users. He has equipped a 6-passenger airplane for radio experiments and tests and is spending much time aloft.

The home port of this airplane, which is as beautiful as it is practical, is Curtis Field, Long Island, New York. She has a berth in the big hangar of the Air Associates. It is an ideal location, for scores of planes of many types hop off and land at this great commercial airport daily.

The private cabin monoplanes that New York brokers are buying daily from dealers on the field, the little two-seaters that independent pilots use for taking passengers up for short spins, the big amphibians such as carried Tunney from his training quarters to his victory at the Yankee Stadium, all have their own peculiar problems. The Flying Laboratory is on the field with them. Mr. Sleeper is in constant touch with owners and pilots, studying airplane radio from every angle. He is an aviator himself and was in the Royal Air Force of Great Britain during the World War, so he understands the situation.

Planes operated by air transport companies are flying 10,000,000 miles a year. Nineteen contractors operate 27 air mail lines. Their planes fly more than 25,000 miles a day over 35 states. The 102 cities at which they stop are the trade centers for 62,000,000 people. As much as 13 tons of air mail have been carried in a single day. The weight of an average letter is under half an ounce, and that amount of mail touches the lives and fortunes of an enormous number of citizens.

Already there are 7,700 miles of airways lighted for night flying and there will be 4,000 miles more within a year. There are 1,338 airports and flying fields in use and 665 others are in various stages of development. And yet a radio-equipped airplane is seldom seen. In the daytime pilots depend on their eyes and their knowledge of the landmarks. At night they watch the compass, the altimeter and other instruments. When fog obscures the beacons they are beset by more dangers than threatened the sea captain before the day of the radio compass.

Any competent airplane pilot can fly his ship successfully when he can see the ground and when his plane and instruments are in working order, but radio is needed when fog, clouds, or the darkness of night reduce the visibility to zero and when flying instruments go wrong. It relieves the tension on the pilot if radio can bring him accurate reports of the weather ahead. If he knows that he is heading toward a storm he can steer around it or go down to a landing field and wait for it to pass over.

Eventually, Mr. Sleeper says, radio will be used in dispatching planes and in signalling to them when fields are clear for landing, just as telegraphy is used in the handling of railroad trains. Already our country is being covered by a network of commercial airways. Soon these will be charted like the ocean lanes. They need to be as completely marked by beacons as the river channels and the coastwise steamship courses.

Louis Meier, pilot of the Flying Laboratory.

The work of charting the airways is well begun. An aviator can secure, from the Department of Commerce, strip maps showing the principal routes and as much of the country on each side as a pilot is likely to see while following the courses. Powerful beacons throw beams of light to guide the planes at night on the more important routes. Radio beacons are being developed by the Department of Commerce which will make it even easier and safer for a plane to keep on her course at night than it is, sometimes, by day.

But the radio aids to navigation in the air are of no use to a pilot whose plane has no radio equipment. There is a great need for radio equipment that the owners of airplanes will install and that pilots will use.

Air pilots are as anxious as their passengers and employers to make flying safe. If an accident happens, the pilot is more likely to be smashed or burned alive than anyone else. Nevertheless, pilots do not like to bother with radio apparatus as it is at present, in spite of the fact that it can add an element of safety.

Mr. Sleeper says that the student flyers disliked radio so much that sometimes they deliberately broke connections on the code practice transmitter to get out of attending the code classes. These men were under the stress of war. Anxious to fly, they had been forced to learn to send and receive code messages in addition to all the rest of their hard work. They were under orders to listen in for signals, and to signal back to the ground station while making observations. It was just one more thing to vex a man whose eyes, ears, hands and brain were already overburdened with details.

Pilots of today are not opposed to radio, but they refuse to interest themselves in understanding the dots and dashes. It takes real skill to handle radio in the air, and the combination of capable pilot and competent code operator seldom happens.

Mr. Sleeper's job, and that of other experts who are at work on the same problem, is to simplify airplane radio so that pilots can use radio beacons and weather reports with no more effort than it takes to glance at the altimeter or the tachometer.

Flying over the Atlantic off Long Island in The Flying Laboratory and watching the ocean liners far below, it is easy to understand that the air pilot has all the difficulties of the ocean navigator, in addition to many that are peculiar to the airplane. The sea captain, out of sight of land, has plenty of time to take observations on the sun or stars and check his course, but the air pilot cannot leave his controls for a second. Sailors, asked where the nearest land is, often say, jokingly, that it is straight down. The same always is true on aircraft, and it is no joke. That land straight down is a constant menace except for a few open spaces, far apart, that are smooth enough to land on.

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The sea captain does not have to worry about altitude, for his chart shows him the permanent positions of the rocks and shoals, but altitude means life or death to the air pilot.

The navigator has a quiet room in which to make his calculations and think out his problems. The air pilot is deafened by the noise from his engine and propeller, and he has to make his calculations in his head and in a hurry. He cannot walk about to relieve muscular strain and nervous tension, but must sit in the same position hour after hour.

The navigator can puff contentedly at his pipe, cigar or cigarette. The aviator always must think of the gallons of gas in the tank within arm's reach, and the possibility of a leak and an explosion.

The navigator can guide his ship through the night in mid-ocean with the assurance that he will not strike a rock or shoal and that the positions of most of the other ships and obstructions in his vicinity are known. The quartermaster at the wheel keeps the ship on her course and the bow watchmen look out for trouble ahead. The airman is never more than a mile or two from death and he has to be his own steersman and lookout.

The fuel can give out on a steamship, or the machinery break down, and she still can keep afloat and have a chance of being saved. But when an airplane runs out of gas, or the engine stalls, the only chance that her pilot has of avoiding disaster is to find a landing place within the next few seconds.

In spite of all the difficulties of aviation, however, the percentage of accidents compares favorably with that in navigation and railroading. Most of the accidents, featured in the newspapers because flying is comparatively new, are due to the taking of needless chances which careful pilots do not take. One pilot who crashed recently had placed a passenger's suitcase where it might easily interfere with the controls. When the wrecked plane was found, the position of the dead passenger indicated that he had been trying to dislodge the suitcase from the steering gear.

It is said that Carranza, Mexico's ambassador of good will to this country, took off for home with a heavy load of gasoline and no dump valve, and in the face of storm warnings. He clipped the tops of trees for some distance before he crashed, which indicates that his plane lost altitude and that his last moments were spent in a desperate effort to rise.

Eliminating accidents that are caused by failure to take precautions known and practiced by every experienced pilot, present-day aviation shows a high percentage of safety and reliability. When The Flying Laboratory has completed her work of developing airplane radio sets that will make it easy for pilots to locate radio beacons and to hear frequent weather reports—sent by radio telephone, not telegraph—air travel will become safer than automobile travel on congested highways where anyone may drive who can pass a very easy examination.

M. B. Sleeper, who originated the idea of taking a radio laboratory into the air.

Among the special problems that radio encounters in aviation are antenna design, noise and simplicity. The Flying Laboratory is attacking all of these.

Like other airplanes, she has used trailing wire antennas. These are unreeled after the ship is in the air and reeled in—if the operator remembers it!—when she comes down for a landing. These antennas have a lead fish on the end to hold the wire steady in the air. Sometimes the fish gets off the wire and dives, and there always is a chance that it may "bean" someone down below.

The Bureau of Standards has experimented with a vertical rod antenna, in connection with its development of aircraft radio beacons. The results have been encouraging. This antenna responds very little to the horizontal electrical field of the radio wave and that is a great advantage in radio beacon service. Pilots, however, prefer not to use anything that offers resistance to the air as such an antenna does, and the amount of energy gathered from the radio waves by such a rod is limited by its small height.

The Loveless antenna, which has produced greater volume of sound at the receiver than a 100-foot single-wire antenna erected twice as high above the ground, seems well adapted to airplane work except for receiving signals from radio beacons. It can be mounted in the wings or tail and will not interfere in any way with the operation of the plane.

The Flying Laboratory has carried loop antennas and the results are very satisfactory, especially in reducing engine noise in the receiver.

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The Flying Laboratory. Mr. Sleeper is in the white sweater.

Compass Installation and Correction

By M. F. Schoeffel
Bureau of Aeronautics, United States Navy Department*

THE saving of time that results from flying across country on compass headings is beginning to be widely recognized. At the same time the general use of steel tube fuselages has made a knowledge of compass correction much more necessary than was the case when wooden fuselages were the rule.

This article has been prepared primarily for the benefit of the pilot who has never studied navigation and who does not desire to go into the subject more deeply than to be able to fly compass courses with confidence. It also contains material for the designer who wishes to install his compasses with the expectation that they may be accurately corrected.

I. Causes of Compass Errors

The most common causes, due to which airplane compasses fail to indicate the true north are: (a) magnetic variation; (b) magnetic deviation; (c) vibration; (d) faulty compass.

MAGNETIC VARIATION is the name generally given in the United States to the angle by which a completely undisturbed magnetic compass fails to point to the true north. Magnetic variation is frequently called "declination" in the Air Corps of the United States Army and in Europe. It is due to the fact that the north magnetic pole of the earth lies in Northern Canada and not at the true north pole.

MAGNETIC DEVIATION is the name given in the United States Navy to the effect of the magnetic materials of the airplane upon the compass.

VIBRATION of the airplane, if sufficiently severe, may cause jumping or even spinning of the compass while the airplane is in straight flight.

The most common causes of a FAULTY COMPASS are: (a) loss of liquid; (b) pivot off the jewel; (c) canted card; (d) cracked jewel; (e) blunted pivot.

II. Discussion and Elementary Explanation of the Causes of Error and the Methods of Correction

(a) Compass Marking

As a preliminary it should be said that all American compasses are marked on the following general system:

North is called 0 degrees; Northeast is called 45 degrees; East is called 90 degrees; Southeast is called 135 degrees; South is called 180 degrees; Southwest is called 225 degrees; West is called 270 degrees; Northwest is called 315 degrees. In other words, all directions are given in degrees of a circle, north being 0, and the angle being measured to the right from north. It is common to mark the card as follows: North is marked N; 30° is marked 3; 60° is marked 6; East is marked E and so on around the card, with unmarked lines at each 5° interval. Since airplane compasses are mounted ahead of the pilot, the figure N is actually on the south side of the card and the figure S on the north side, but the system remains the same. This is illustrated in Figure 1.

(b) Magnetic Variation

MAGNETIC VARIATION is the angle by which a completely undisturbed compass fails to point to the true north. It is not a constant angle, but varies throughout the world. THE COMPASS CANNOT BE CORRECTED FOR VARIATION; it is necessary for the pilot to know the variation for the general region in which he is flying. It does not change very rapidly. In general, it will not change more than about 1 degree in a 100-mile east-west flight, and much less in a north-south flight. The value of the variation is marked on the aeronautical strip maps issued by the Air Corps of the United States Army and the Hydrographic Office of the United States Navy and is marked on most good commercial maps. On the Army maps it is generally marked in red on the edge of the map, and is given without a name, as "$7\frac{10}{2}$—." The variation is given as, for example, "6 degrees easterly" or "10 degrees westerly." Easterly variation means that the compass needles are pulled to the east or right of the true north, and, therefore, the compass reads less than it should by the number of degrees of variation. For instance, suppose the variation is 5° E, and it is desired to find the compass heading corrected for variation corresponding to a true heading of 45°. This corrected heading, which is known as the MAGNETIC HEADING, is then 45° minus 5° equals 40°. If the variation is westerly, it is added to the true heading to find the magnetic heading. The Army Air Corps strip maps have marked alongside the courses from place to place the value of the magnetic course. This means that the variation has already been applied to the true course and it is not necessary for the pilot to apply the variation correction.

In case no values of the variation can be found on the map to be used, the pilot can determine it with fair accuracy on the ground by the following method: Set a compass on the ground at least 50 feet from any large masses of steel or iron, or electric wires. Line up the lubber lines of the compass carefully on true north and south by sighting them on the North Star, or by aligning them on streets or section lines which are known to run due north and south. After the compass has steadied down, read the compass. If it reads, for example, 30°, the variation is 30° west. If it reads, for example, 330°, the variation is 30° east. It will be noticed that in the first case the needles have been pulled to the west of true north and in the second case to the east of true north, hence the names westerly and easterly. After taking a reading it is advisable to move the compass about 20 feet to see if the two readings check as the compass may have been accidentally placed over a buried pipe line or other mass of iron.

Actually the variation is now 20° westerly in eastern Maine and decreases to 0 on the general line Saginaw, Cincinnati, Savannah, and then increases to 26° easterly in the state of Washington.

(c) Magnetic Deviation

MAGNETIC DEVIATION is the compass error due to the presence of iron or steel or to the effect of electric wiring in the airplane. It varies with each direction in which the airplane is headed, but it can be corrected nevertheless, and the compass made to read magnetic headings or within 2 or 3 degrees of magnetic headings.

Without going at all deeply into the theory, the following simple explanation

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can be given. Suppose one of the longerons forward of the compass has become magnetized in some way with a north pole near the nose and a south pole nearer the compass. Then, when the airplane is headed north, this south pole in the longeron will attract the north pole of the compass needle and hold the compass on north more strongly than usual. When the airplane is headed east, the compass magnets should lie directly athwartships, but the south pole in the longeron will pull the north end of the magnets to the east and cause an easterly deviation (so-called because the compass needles have been pulled to the east). When the airplane is headed south, the south pole in the longeron will tend to repel the south pole of the compass needle, which pole is now toward the nose of the airplane and will weaken the effect of the earth's magnetism.

When the airplane is headed west, the compass needles should again lie athwartship, but the south pole in the longeron will pull the north pole of the compass needles to the west this time and cause a westerly deviation (so-called because the needles have been pulled to the west of north).

It must be understood that had the longeron become magnetized with its south pole forward, the effect would be just opposite. This is far from being the complete theory but illustrates one of the commonest cases of deviation in airplanes. The deviation can be easily corrected by putting small compensator magnets in the compass which will give an effect equal and opposite to that of the iron of the airplane.

All Navy and most commercial compasses have underneath the compass two tubes, one fore and aft and one athwartships, in which these compensator magnets may be placed. The Army instrument-board-mounting compasses have these tubes on top. These tubes are usually covered by a cap held in place by two screws. Back off these screws and turn the cap a bit; the tubes will then be uncovered and the magnets can be placed in them and then held in place by resetting the cap and screws. Compensator magnets are always furnished with new compasses or can be obtained from compass manufacturers.

The method of placing the magnets is as follows: Head the airplane accurately on magnetic north (true north corrected for variation). Put magnets in the athwartship tube until the compass reads north. If a magnet is put in and it makes the error worse take it out and put the other end in first. Magnets of varying strengths are usually furnished, but if no magnet can be found that is not too strong, break one in two, tap it on its end a few times and try it. Use the athwartship tube because the best way to close a door is to push at right angles to it, not along it.

Then head the airplane east magnetic (90° from north magnetic) and put compensator magnets in the fore and aft tube until the compass reads east. Most of the work is now done. It may not be possible to find a combination of magnets which will make the compass read exactly north and east. In that case try to get it within 2 or 3 degrees short of the point which is being tried for. If the compass is pushed past the point it is over compensated and will be sluggish.

Now swing to south magnetic. If the compass reads exactly north on north magnetic it should read south on south magnetic. If it does not read south, change the athwartships magnets to take out half the error. If it reads say 2° west deviation (2° reading) on north magnetic it should read 2° east deviation (178° reading) on south magnetic. If the same deviation in the opposite direction is not found on south magnetic as on north magnetic, change the athwartships magnets to take out half the difference. For instance, suppose the deviation on north magnetic was 2° west (2° reading) but instead of being 2° east (178° reading) on south magnetic, it is 6° east (174° reading). In such a case change the athwartship magnets to give 4° east deviation (176° reading) on south magnetic.

This is an eminently practical article on compass adjustment by one whose authority and knowledge cannot be questioned. The subject is not one that is ordinarily covered in mechanic's courses.

Now swing to west magnetic. If the compass reads east on east magnetic it should read west on west magnetic. If it does not read west, change the fore and aft magnets to take one-half the error. If 3° easterly deviation (87° reading) was found on east magnetic, a 3° westerly deviation (273° reading) should be found on west magnetic. If the deviation on west magnetic is not the same in the opposite direction as on east magnetic, take out half the difference as was done on south magnetic.

After having checked on north, east south and west, it is advisable to head the airplane on at least every 45 degree magnetic heading, that is, on North magnetic; 45° magnetic; East magnetic; 135° magnetic; South magnetic; 225° magnetic; West magnetic; 315° magnetic, or better still, on every 30 degree magnetic heading and find what error remains. Even if the compensation has been perfect on north, east, south and west, small errors may still exist on the other headings due to the existence of factors not discussed here.

The errors which are found on this complete swing should then be put in the form of a table and the table posted where it can be readily seen. One of the handiest forms is given below:

Magnetic Head	Compass Head
North	2°
30	33
60	62
East	90
120	119
150	149
South	178
210	209
240	241
West	270
300	302
330	332

In order to place the airplane on the desired magnetic headings it is necessary to lay out these headings. This can be easily done by setting a compass on the ground about 50 feet from any large masses of steel, and setting out two pegs accurately placed on the north-south line indicated by the compass. The pegs should be placed a distance apart about twice the length of the airplane to be swung. Then with the distance between these pegs as a diameter lay out a circle and mark it off in degrees with pegs at every 45°, or better, every 30°. In getting the magnetic north-south line of this compass rose, care should be taken to see that there are no compensator tubes.

In getting the compass error on the various headings it is important that the control stick, if of steel, be held in the approximate level flight position and that, if the fuselage is of steel, the tail be lifted until the fuselage is in the approximate level flight position. For accurate work it is desirable to have the engine warmed up and running while getting the compass error, but it is very seldom that this is really necessary.

Placing the compensator magnets in the tubes can be made much easier by using a pair of brass tweezers to handle the magnets as they will not stick to brass. If the deviations are found to be 5° or less before the compensator magnets are put in, it is better not to compensate at all, but just to swing the airplane on the various magnetic headings and make a table of the deviations. Using the compensator magnets always makes a compass somewhat more sluggish. If any of the deviations are over 30° it is best to try to find a new location for the compass, as compensating such a deviation will make the compass very sluggish. It will frequently be found that moving a compass a few

inches away from steel parts will improve it tremendously.

After the compass has been compensated it may be checked from time to time by lining the airplane on a known heading or while flying in smooth air over streets or section lines whose direction is known and allowing for drift. If steel wires, which vibrate a good deal, are close to the compass, say within a foot of it, the deviation may change considerably after long flights, as vibration of steel gives ideal conditions for changing its magnetism. In one case a deviation was found to increase 16° after a long flight. After an airplane has been in service for some time and has been well shaken down, not much change in deviation due to vibration need be feared.

If flights of a thousand miles or more north or south are to be made the deviation may be expected to change a few degrees due to parts of the theory not given here. Usually this effect can be neglected.

(d) Vibration

In addition to the effect of vibration on deviation, vibration may have another and much more serious effect, that is, to cause jumping or spinning. Once this jumping is seen it is very easily recognized, as the card will be seen to jump very erratically, to swing 20 or 30 degrees to one side very rapidly, to start to swing back, and then to jump and swing off again. If the vibration is very bad the compass may even spin like a top. This vibration jumping should not be confused with the much less jerky and erratic swinging of a compass in bumpy air or while the airplane is being maneuvered. The swinging in bumpy air will average out as in a short time the swings to the left will equal the swings to the right.

Fortunately, this vibration jumping does not often appear and even then only at certain engine speeds. It can usually be overcome by making the compass mount more rigid, by making the surface on which it is mounted more rigid, by moving the compass a few inches, or by using one of the anti-vibration mounts now appearing on the market.

The cause of this vibration jumping is very simple. At best the earth's magnetism is not very strong. When the parts touch, as shown in the lower diagram, the compass card is given a turning push which is much stronger than the holding force of the earth's magnetism.

(e) Faulty Compasses.

One often sees compasses with the card canted and stuck. If this is due to the pivot being off the jewel or to an air bubble having been caught under the card, the condition can frequently be corrected by shaking the compass violently.

The appearance of bubbles means a leaking compass. Bubbles the size of a quarter dollar generally have little effect, but if they become much larger the effect will be bad and the compass should be refilled through the filling plug which is always provided. Some compasses are filled with alcohol water mixtures and some with petroleum derivatives. If the compass to be refilled requires alcohol-water and only bubbles have appeared, add distilled water. If the compass has leaked to such an extent that a free liquid surface has formed, a mixture of 50% distilled water should be added. If the compass is filled with a petroleum liquid, any leakage should be made up by adding water-white kerosene. Do not put kerosene in an alcohol-water compass or vice versa for the result is certain to be bad.

No, reader, this is not the author, but Lt. Cdr. Weems, holding the apparatus for quick determination of position. Correct instruments and a knowledge of avigation go hand in hand.

A cracked jewel or blunted or broken pivot will cause the card to rotate jerkily or even to stick completely. This condition may be found by holding a magnet near the compass until it has turned about 10°. Then take the magnet away suddenly. The compass should return to its original reading within 2°.

III. Installation of Compasses

Whenever possible the compass should be installed on the fore and aft center line of the airplane. The lubber lines must be accurately lined up with the fore and aft center line.

No definite rules can be laid down for the distance of a compass from magnetic parts to insure a given deviation, as the deviation depends upon the degree of magnetization which the parts have accidentally acquired. However, if the airplane designer keeps the following recommendations in mind, he may confidently expect that the magnetic conditions surrounding the compass will be good.

The following distances should be allowed between the compass and parts, *if magnetic:* (a) structural rods and wire, 15″; (b) fire walls, 24″; (c) tanks or floor plates above or below the compass, 15″; (d) tanks on the center line ahead of or behind the compass, 24″; (e) tanks not on the center line, 30″; (f) Cowling or instrument board, 24″; (g) Movable parts, such as the control column, 18″; (h) untwisted direct current wiring, 36″; (i) essential removable parts, such as cranks and tool kits, 36″; (j) engines, as far as is consistent with good visibility of the compass. If direct current wires are twisted one over the other they have no effect. Alternating current wires have no effect.

To double the distance from a magnetic part decreases the effect of that part to approximately one-fourth of its previous value.

Steel, iron, and terne plate, since the last contains iron, are practically the only magnetic materials used in airplanes. Duralumin, aluminum, brass, bronze, and wood have no magnetic effect whatever upon a compass.

The compass should be so installed that access to the compensator magnet tubes is easy. The compass should be secured to a surface which is sufficiently rigid not to magnify the airplane's vibration.

IV. Summary

To mount the compass: See that it is filled, the card not canted, and the card working freely. Line it up on the center line where it is well away from magnetic parts, easily visible, rigidly secured and the compensator tubes accessible.

To compensate the compass: Stow the tool-kit, crank, etc., where they are usually carried. Head the airplane on magnetic north. Remove the deviation by putting magnets in the athwartship tube. Head the airplane on magnetic east. Remove the deviation by putting magnets in the fore and aft tube. Head the airplane on magnetic west and remove half the deviation. Place the airplane on at least the eight magnetic headings 45° apart, beginning with north, and make a table of the compass headings corresponding to the magnetic headings. Whenever the compass reading is being taken the fuselage and controls should be approximately in the position of level flight and the compass should be tapped with the finger.

To check the compass: Occasionally compare the compass reading, when the airplane is on a known magnetic heading, with the value given on the table.

The small amount of work required in compensating a compass will be well repaid by the resulting ability to fly across country without following railroads.

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The Moral Aspect of Aviation

By Margery Brown

"WOMEN who fly," was the topic of our conversation.

This particular pilot to whom I was talking did not seem to be especially averse to women flying—probably because he had never attempted to instruct one!

Speaking of giving flying instruction to women, I am reminded of an original viewpoint expressed by a flyer who summed up the difficulties in this wise: "Certainly it is harder for a man to teach a woman than it is for him to teach another man! Probably it's because there is always a fundamental lack of understanding between a man and a woman. Sometimes it amounts to antagonism. In his personal relations with the fair sex, a man is completely at sea half the time. He seldom has the least idea how a woman is going to react. The same applies when he is teaching her to fly."

If this is conceded to be true, it is something in favor of women training to be instructors. Possibly if a woman were sufficiently expert as a flyer, she would have more success instructing women than men do. With the clash of sex eliminated, flying instruction might be considerably easier, both for instructor and student. This is mainly a matter of psychology, but it deserves attention.

To return to the pilot mentioned in the first paragraph; he had talked to a number of women flyers, and was interested in knowing what it was about aviation that appealed to them. When I said I thought its moral value was paramount, he seemed to be puzzled.

"I know an awful lot of good flyers," he assured me, "who come a deuce of a long ways from being what I call moral!"

He simply did not put a broad enough interpretation on the word "moral." The truth is, that any right thought is a moral thought; any right action is a moral action.

If you are going to fly, there are certain qualities which you must have; and if you do not possess them, and do not develop them, the chances are that you won't go very far.

You can't be a "quitter," for instance, if you want to fly, and to be a quitter, or a coward, is, to my mind, immoral. But, to stick to a thing no matter how many obstacles you encounter; to keep plugging away, to be persistent, to refuse to be discouraged, to refuse to give up—that's what I call being moral. There are other ways of being moral, too, but this assuredly is one way.

Flying for pleasure doesn't call for a very great amount of stamina, but if you are going to make a business of it, you'll need plenty of "guts." Situations arise that require it. One is not aware of this who visits a flying field casually for an hour or so; he must be there constantly, to appreciate what flying as a profession demands.

A short time ago I saw an instructor get out of a ship in which he was about to give instruction, and crank it up himself because the engine was balking and the mechanic couldn't start it.

This was a particularly mean motor, which had caused previous trouble due to its tendency to "kick back." It kicked back this time and the propeller broke several bones in the instructor's hand. Two students were waiting. There was no one on the field at the time who could take the instructor's place. So, he pulled a glove over the hand, said it was nothing, and spent over an hour instructing!

Margery Brown in her most admired helmet. The helmet carries the autographs of many famous flyers.

Giving instruction is, in itself, enough to tax the patience of Job. Fancy doing it under these conditions.

When he had finished with the students, he went to the hospital and had the bones set.

This is the sort of stuff you have to be made of, if you want to take up flying.

Due to the lack of opportunity for women in commercial aviation right now, they will probably do most of their flying for pleasure for some time to come. Yet, the fact that they are flying for pleasure does not relieve them of moral responsibility. They should strive to give to aviation their very best, and seriously consider how it can be done. If they have faults that interfere, they ought to be willing to try to overcome them.

I have talked to a good many women who are learning to fly, and I believe that many of them make the mistake of flying "on their nerves." They appear to get themselves keyed up to a certain point, then grit their teeth and go ahead, depending on this nervous energy to sustain them. The trouble with nervous energy is, that it leaves nothing in reserve. While events run smoothly, as planned, nervous energy sees a woman through; but the moment a serious unforeseen difficulty presents itself, this energy collapses. Then the woman "blows up," to use a current phrase.

Women need to learn to be more relaxed when flying; quieter, calmer. They should try to overcome the tendency to excitability and tension. This means, primarily, that they should learn to be more relaxed, emotionally.

The opinion which I am about to express may meet with opposition in certain quarters, but I believe women who want to fly would be better off if they gave up smoking entirely. Women do not appear to be able to take cigarettes or leave them alone, as men do. Cigarettes are indubitably harder on a woman's nerves; she depends too much upon them. They "key her up," and when she has been keyed up too much, she wants another cigarette to quiet her down. It is an endless circle. Cigarette smoking is a very bad habit for a would-be lady pilot to cultivate.

While the average woman appears to be too tense and nervous, there is another extreme of carefree over-confidence, which is just as bad or even worse. To strike a balance between caution and freedom seems essential.

When a confident type of pilot has had between twenty-five and fifty hours of solo flying, he is apt to become somewhat of a "Smart Aleck," as the saying has it. Frequently he begins to think that he is pretty good. This is the time to beware. You can't be "cocky" when you're flying. Aviation won't let you get that way. It promptly takes it out of you. It keeps you humble.

Other characteristics that are necessary if one is going to fly, are: self-control, discipline, attentiveness, alertness and persistence. These all are moral qualities, aren't they? I could think of many more.

Regarded in this light, it is easy to see that flying really constitutes a moral education.

Current Comment

NO publication that is issued for the benefit of an industry and having the interests of that industry at heart can consider itself of importance and value unless it becomes a medium of progress and an expression of the forward looking minds that have attacked the problems that present themselves to any fast growing business.

POPULAR Aviation and Aeronautics feels that the time has come to offer a program, or platform, that will look toward the elimination of some of the difficulties and handicaps that exist today. Let us here acknowledge our indebtedness to the many men whose comments, suggestions and criticisms, founded on wide experience, have led to the formulation of this platform.

Unified Government Aviation Training Schools

It is obvious that both Services exist for the national defense and for no other reason. It is also obvious that training should follow war conditions as nearly as possible. In the event of war one of the first necessities will be the combining of all aviation activities under one head. England found this a positive necessity during the Great War, in fact, unbiased readers of the record cannot escape the conclusion that much of the toll of lives was a result of departmental policies against such a combining of air forces, due to bureaucratic jealousies and other petty motives.

IF we are to consider the necessities of war in the light of previous experience it is impossible to overlook the ultimate combination of military and naval air forces. For that reason alone, the present combination of training facilities under one responsible organization will be a step toward training under conditions that will obtain should aerial defense become necessary. This single training school, though split into various units, located in various states, would provide the great reservoir from which the Army and Navy could draw their officer material. Such a school would offer economies in operation and standardization. It would provide a reserve personnel that could be drawn into either branch of the service in case of national emergency. It would be the first step in the ultimate unification of all air activities of the Government.

A Secretary for Aviation

Aviation has possibilities far beyond those of motor or rail transport. Simply because of its defensive and offensive capabilities in war time, its virtual annihilation of time and distance, it cannot longer be classed as an adjunct to any arm of the service. Commercially it bids fair to become of the greatest importance.

FORWARD looking nations are not without separate air ministries, in whose charge are the development and regulation of aviation. This country cannot lag behind.

It is hard to give the proper measure of credit to the Hon. William P. MacCracken, who, as Assistant Secretary of Commerce for Aeronautics under Secretary Hoover, has been in charge of civil aeronautics during what has probably been one of the most trying periods possible. Regulations have been formulated and enforced, not with bureaucratic officiousness, but with insight and intelligence, and with the co-operation, understanding and assistance of the industry so regulated.

IT is now time, with a new President about to take office, to consider the creation of a new portfolio for the Cabinet—that of Secretary for Aeronautics. It is the feeling of many, who should be in a position to know, that President-elect Hoover, with his sympathetic understanding of the problems of aviation, and his knowledge of its possibilities and requirements, will seriously consider this move. It is time for aeronautics to take its place in the Cabinet.

International Certificates of Air Worthiness

English aviation journals have commented on the situation now existing with regard to air-worthy certificates. Some agreement may have been reached with Great Britain by the time this appears in print, but that agreement will not obviate the necessity for remedying a situation that can recur in our air relations with all foreign countries.

TO put the matter briefly, foreign countries are unwilling to accept the certificates of other countries as to the air-worthiness of aircraft. As regulations, methods of testing, even engineering standards, vary in all countries, it becomes a matter of necessity to speedily arrive at some code by which aircraft may be judged. As matters are today, no foreign plane can obtain a certificate in this country, and no American plane may obtain one in England. With our manufacturing facilities this country should become a large exporter of airplanes. An international standard will become a necessity before our manufacturers can supply the great markets outside our borders. The President of the United States should invite the powers to a conference at which such a code could be drawn, and facilities for the granting of international certificates provided.

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Current Comment

Inspection Certificates

The matter of certificates and the international recognition of them would be furthered by a development of an inspection system that covered every major operation in the manufacture of aircraft. Some manufacturers would object to making this inspection a function of the government. Without going into the merits of this objection, it is not necessary that such inspection be made by government officials, provided it be done under rigid supervision.

A MANUFACTURERS' association which adopted the principles of any international code could put such an inspection into effect. It is fairly well established that our coming President believes in letting industry regulate itself. Certainly aircraft manufacturers could expect the maximum of help on such a program and a minimum of interference from the government. The effect upon the buying public would be a salutary one. It would definitely stop the circulation of some of the wild tales that are passed from Gossip to Gaffer regarding the construction of the "Plummet," long noted for its dropping ability.

Longer Terms of Training

Wherever one goes in aviation company it is possible to hear much criticism of the schools. Any attempt to sift the justified criticism from the chaff is a difficult one. Several things are certain. One is that there are many good schools, schools run so as to produce excellent pilots and mechanics. Another certainly is that there are schools so operated that graduating students is merely incidental to the making of money.

GOOD schools are laboring under the disadvantage of having to compete with unethical schools. Rates for tuition must be reasonably competitive. Either type of school can turn out a ten-hour man, but there will be a vast difference between the men. The poor school cannot turn out the fifty-hour man, as its whole "set-up" is based on getting the student out. The elimination of the ten-hour course would probably eliminate every poor aviation school in the country.

Opposition to Unfair Publicity

Sooner or later the industry as a whole must take some concerted step to combat sensational news stories of crashes. We can be glad that aviation is still news to the public, but the picture has a darker side to it. With little effort the manufacturers' association persuaded the news companies to leave out the names of crashed planes. With a little more effort it will be possible to obtain consistently fair treatment and unbiased statement in all news stories pertaining to aviation. One cannot help recalling the bureau set up by one of our present churches. Prejudicial statements in the press were consistently challenged by this bureau in such a logical way that news editors thought twice before printing such material.

SUCH a bureau could be operated at comparatively small expense. Any of the publications devoted to the field would be glad to house such a bureau and direct it. The clerical work would be small, and the cost, split between the interested and benefited manufacturers, insignificant.

Integrity in Advertising

One of the positive ways in which the publications in the Aeronautical field can assist the industry is to keep advertising columns clean and free from all suspicion. To that end we are pledging our good faith, and it is unnecessary to state that we will have the active support of all the other publications devoted to aeronautics.

EVERY rapidly growing business, particularly those receiving the attention of the great reading public, passes through a stage when parasites attach themselves to it and attempt to make a living on the efforts of legitimate business. Aviation has not been entirely free from this pest, but honest effort by the publications of integrity can go far towards eliminating it. Next month we will have more to offer on this score.

An Advisory Advertising Board

It is our intention to create an advisory board, consisting of men whose prominence and good faith are unquestioned. All advertising scheduled for appearance in these columns will be submitted to this board for the approval of these men. Questionable statements, false inferences, distortions of facts, and misrepresentations will not be permitted. To such advertisers who desire the service we stand ready to make an investigation, which will be complete and competent, of the service or product which they offer our readers, and, if this investigation shows this service or product to be worthy, to permit the use of an insignia in their advertising, as a hall-mark of excellence. The full details of this plan will be found in our columns next month. It is our belief that advertisers will welcome this plan. We know that readers will receive many advantages from such a policy, and, as the advantage of the buyer redounds to the benefit of the advertiser, this plan cannot fail to assist every advertiser in setting forth his message to the great buying public represented by the readers of POPULAR AVIATION AND AERONAUTICS.

From Picks to Props

By Ensign Bilge

Part 3

IT was August—two months ago we were just beginning our preliminary training course. Each of us had a little over forty hours of flying time, but we were still embryo aviators and the advanced course was yet before us.

The Naval Air Station at Hampton Roads, Va., even at nine o'clock at night impressed a group of seven newly arrived plebes as a sort of Heaven. Coming from a small Naval Reserve Air Station where we were quartered aboard an old yacht, crowded and uncomfortable, we were pleasantly and agreeably surprised to be assigned to large and roomy quarters. We occupied the upper deck of what we found the next morning to be the mess hall. The building was situated at the end of a quadrangle of eight such structures, two on either side and one on either end. The most startling of our discoveries was the fact that we were to have real beds, cots with genuine springs and mattresses. What a contrast to those dingy bunks we had occupied aboard the Hawk! Plenty of fresh air, and light from the large windows, roomy steel lockers in which to stow our belongings, large tables and benches where studying would be a pleasure, these were the most attractive features of our new home.

Six students from other Reserve units had arrived the day before and after having made ourselves acquainted we were anxious to try out the tempting cots. The class numbered thirteen. Before I closed my eyes in sleep that night I wondered, and I believe there were others who did the same, if 13 was to play any part in the destiny of that group of young fellows.

Out of habit I awoke at 5:30 the next morning but seeing no signs of activity I rolled over and continued to "pound my ear." Reveille was sounded at 7:00 and our fellow students who had arrived the day before told us that breakfast was at 7:30 and that we would eat in the Chief Petty Officer's mess. At 8:00 o'clock all hands mustered, the roll was called and absentees reported, and then the various squadrons were marched off to their respective hangars.

What a contrast were these huge steel hangars with their gaping doors now open revealing, seemingly, hundreds of planes of various sizes and types, to our two tiny wooden hangars at Great Lakes, with their canvas doors, and housing our squadron of three N-9's of which we had been so proud. We stood admiringly as the huge planes were pulled out onto the concrete aprons by Fordson tractors. There were small fighting planes, there were single engined and twin engined bombers, there were torpedo planes, and planes we had never even seen pictures of before.

It was only with considerable difficulty that the thirteen students were finally assembled from their many expeditions of exploration and ordered to report to the flight surgeon. It was necessary to get a medical indorsement on our orders before we would be allowed to fly. It was practically impossible to extricate oneself entirely from the mazes of red tape, of which the Navy seems to have an over supply.

"I'd rather have typhoid than these damn shots in the arm," I said to Red, who was just ahead of me in the line. The medic was passing along with a bottle of iodine in one hand and a swab in the other, decorating each left arm with an unsightly dab of brown.

"Think nothing of it," replied Red. "Look at all the free doctoring you are getting."

The line was moving slowly and as each victim emerged from the door, paler than when he entered, he rolled down the sleeve of his jumper and with an expression of, "thank goodness the first one is over," passed on out to breathe the fresh air. Each morning we were required to report for a physical examination which consisted of nothing more than looking us in the eye and ask-

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ing us how we felt. One student resented the bother necessitated by the apparently worthless exam and in doing so impressed the flight surgeon quite unfavorably. Within a week he was bilged as psychologically unfit for duties involving flying.

"Look at this fellow come in; bet he won't clear the hangars by ten feet," said Red quickly as we were standing in front of the hangars watching, for the first time, an H-boat come in for a landing.

"They certainly come down hell-bent," I replied. "And the roar of those Liberties make our Hissos sound like puddle jumpers." The pilot had made his approach from a point some distance inland behind the hangars, and in order to land close into the beach he cleared the hangars by a very few feet. The "flying casket" looked huge to us as it came in directly over our heads to a pretty landing. We decided to get better acquainted with our future charges.

The HS-2L, too, has seen its period of usefulness and is no longer in use by the Navy, having been replaced by amphibians and more modern types. It was a plane of the flyingboat type, consisting of a hull to which the wings and tail surfaces were directly attached, as distinguished from the N-9 or pontoon type, which is similar to the landplane except that it is supported by either one or two pontoons in the place of wheels.

The HS-2L had a wing span of approximately seventy feet and was powered by one 400 h.p. Liberty motor using a four bladed propeller. The propeller end of the motor was aft, the propeller itself being just aft of the trailing edge of the wings. This is known as the pusher type as compared with the tractor type which has the propeller in front. In the bow of the hull was situated the gunner's cockpit connected to the pilot's cockpit just aft by a small door through which only a contortionist could crawl with ease. The pilot's cockpit was just forward of the leading edge of the wing and was anything but convenient in case of a crash, due to the fact that the motor, situated between the wings behind and a little above the pilot, had a tendency to make its exit directly aft of the instrument board. Twelve hundred pounds of motor acting in accordance with Newton's law has no respect for pilot or plane. The moment of thrust of an H-boat was above the center of gravity and upon cutting the motor the nose of the plane would tend to rise. It was emphatically impressed upon us that it might be embarrassing for a pilot to linger long in pushing the controls forward when the motor stopped, due to the fact that an H-boat loses about a thousand feet per turn in a spin. There are few people who are able to brag about spinning one, although I am told that two years ago a student inadvertently got into a tail spin and recovered from it.

We led the life of Riley as compared to our existence at Great Lakes.

"Come on, Red, rise and shine," I said, shaking him out of a sound sleep. "First call has been sounded for chow."

"I don't want any breakfast," he mumbled, "call me when you come back from chow." With that he rolled over and went back to sleep.

The more sleep a man gets the more he wants, and that extra few minutes of sleep one snatches when he rolls over after being called is worth more than the whole night. I raise my eyebrows doubtfully when someone tells me that he takes an ice cold shower the first thing each morning. An investigation would probably reveal that the temperature of the water used by 80 per cent of these cold shower artists would not be less than 70 degrees. The other 20 per cent of them would very likely be found tucked snugly under the covers snatching that extra ten minutes of shut-eye.

Navy observation seaplane being hoisted in.

Each of us was given a fifteen minute check hop in the one and only N-9 on the station, and the rest of the first day was spent in ground school learning how to fly an H-boat. Being accustomed to working until after dark we found that knocking off at four o'clock every afternoon, left us with a great deal of time to ourselves. At Great Lakes we worked from sunrise until after dark every day, including Sundays—now we worked from eight until four and had Wednesday and Saturday afternoons and Sundays off. With Norfolk, Ocean View, and Virginia Beach in close proximity, fifty-two dollars a month was a meagre allowance and the pay at Great Lakes, that we could not find time to spend, now came in handy.

Our H-boat instruction began in earnest on the third day. The seven planes were lined up on the concrete apron waiting for us. We climbed into the respective planes and sat beside our instructors, on their right.

"Are you ready, Mr. Lee," said the mechanic as he stood by ready to start the motor.

"All set," replied my instructor.

"Switch off?"

"Off."

"Contact." The mechanic succeeded in starting the motor with only two turns of the crank. I was recalling the many times I had skinned my knuckles and ruined a good disposition trying to crank an N-9. The N-9 crank was situated inside the forward cockpit and was of such length that there was barely enough clearance for one's knuckles between it and the sides of the fuselage.

The mechanic took his place in the gunner's cockpit in the bow and we taxied down the runway into the water, and headed into the wind which was blowing directly in over Willoughby Spit. I was glad I had stuffed cotton in my ears, for otherwise the sharp crack of the Liberty motor would have made my ears ring for hours. Being in front of the motor one does not get the effect of the propeller blast or slip-stream and flying is more of a pleasure. In normal flight the horizon is in a position just below the rim of the gunner's cockpit, and our mechanic could be seen peering over the side taking in the scenery. The wings being behind the novice makes it necessary for him to glance back out of the corner of his eye to see if the wings are level. On the dash board is an instrument, nothing more than a spirit level, which indicates the fact that one wing is low. Not accustomed to instrument flying I found it necessary to resort to the horizon method and to rely on what little "sense of feel" I had acquired in my few hours of flying. After a certain length of time in the air a pilot instinctively knows if a wing is down, for he has acquired a "feel of the air."

The instructor cut the gun and began an approach for a landing. The gliding angle of an H-boat is much smaller than that of an N-9 and I noticed that our descent was decidedly more rapid. He leveled off and as the tail of the hull touched the water it felt much as though an anchor or a bucket had been dropped overboard. There was a salty taste in my mouth and as I wiped a few drops of spray from my face with the sleeve of my flying suit there dawned on me the realization that the salty taste was due, not to what I at first suspected, but to the fact that we had landed not in the fresh water of Lake Michigan but in the ocean. By reaching over the side of an

An X-5, a small scouting seaplane.

H-boat one can touch the water and it was with no little astonishment that my instructor watched me as I scooped up a handful of water and held it to my lips.

"What the hell are you doing?" he asked.

"I have never seen the ocean before, sir," I replied, "and I am just finding out how salty it really is."

The next time around the course the controls were turned over to me. It was like driving a truck as compared with flying an N-9 and upon landing I noted a decided tendency to skid to the left.

"You don't hold enough rudder," he remonstrated, "and you leveled off much too high."

Leveling off too high was no doubt due to the fact that one sits much higher off the water in an N-9 than in an H-boat. Not holding enough rudder was due to the fact that I had not become accustomed to the "bungee cord." The torque or turning moment of an H-boat is very pronounced and in order to counteract for this a piece of shock cord or "bungee" is secured to the left side of the rudder bar. This cord, which is adjustable, exerts a pressure tending to create "right rudder," thus relieving the pilot of continually holding right rudder. While in the air the pressure created by the bungee is adjusted to balance the torque or tendency of the plane to turn to the left. The instant the motor is cut there ceases to be any torque and it is necessary for the pilot to then hold left rudder to counteract for the right rudder created by the bungee cord. It is much easier to hold left rudder for a short time while landing than it is to continually hold right rudder while in the air.

As in N-9's there were bad landings and the accompanying curses of irate instructors. It took an average of a little less than five hours apiece to check out for solo. The prescribed course over which we flew was a triangular one of about ten miles on each leg. Beginning at the Naval Air Station as one apex, the other two points were Newport News Middle Ground Light and Old Point Comfort. The direction of the wind determined whether the course was to be flown clockwise or anti-clockwise. No turns over ninety degrees were allowed but this permitted students to practice figure-S turns. A separate area near Middle Ground Light was designated as the spiral field.

The H-boat, designed to carry a gunner in the bow, was not properly balanced for solo work, so weights totaling the approximate weight of a man were placed in the bow to prevent tail heaviness. Our only companions on solo flights were these unappreciative sandbags.

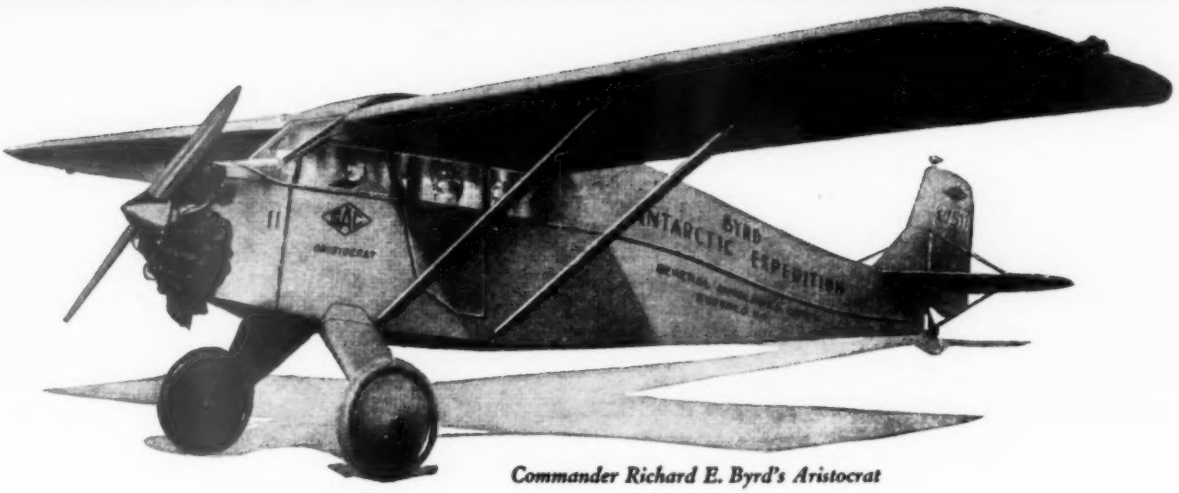
On my third solo hop I was rather unfortunate in the respect that three different persons took it upon themselves to see that my No. 13 was provided with the necessary ballast. It was no small wonder that, with some four hundred and fifty pounds of excess baggage in the bow, the plane was reluctant to take off. It did take off, however, but it was a valiant struggle on my part to keep it from mowing down all intervening fish stakes between the Station and Middle Ground Light. With the controls half way back to my chest and only ten feet of altitude it began to dawn on me that something must be wrong, and I had my suspicions. Upon landing I climbed forward into the gunner's cockpit and unloaded the three hundred pounds of extra weight and in tossing one of the sandbags over the side my goggles fell into the water and sank to the bottom of the bay. It was fifteen miles back to the station, and no goggles. If I taxied back the motor would undoubtedly boil over and besides that I would be razzed to the end of my days. I learned much about instrument flying on that return trip. To keep the wind from flooding my eyes with tears it was necessary to duck behind the instrument board and depend on two tiny bubbles for equilibrium. Bubble to the right—kick left, bubble high—ease the wheel forward, etc.

The landing I made without goggles, although a fair one, reminded me of the story one of the officers tells of his experience on a certain morning after the night before. His depth perception was still many millimeters off, for he ended his tale thus:

"After flying around for some time I came in and leveled out to what appeared to be a beautiful landing—I turned and started to taxi to the beach, when, much to my embarrassment, I found I still had twenty-five feet of altitude."

One day I was just taking off, the plane was on its step, the left wing began to drop and in an effort to bring it up I

Formation flying is never lonesome.



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A P-N-7 Navy bomber. This was flagship of the bombardment flotilla.

discovered that the ailerons were jammed. Having the presence of mind to cut the gun immediately was the only thing that averted a very probable crash. An investigation on the beach proved that the balance cable on the upper wing had jumped its pulley and was rigidly caught between the pulley wheel and its housing. For many days subsequent to this episode the possibility of a repetition of a jammed aileron hovered over me like a spectre. Events such as this one created in my mind a tense mental attitude that probably would not have affected the average pilot, but it must be remembered that I was still a novice and it was only three weeks previously that I had pulled myself from a tangled mass of airplane wreckage. I would not admit to my classmates that I was still a bit shaky from my crash for fear they would think I had a yellow streak. I tried to assume a false bravado.

Each day we had ground school classes and every Saturday morning an examination on the work covered during the week. We studied the practical and theoretical phases of motors, airology, structure and rigging, navigation, theory of flight and practical flying, bombing and gunnery, radio, tactics, and other purely naval subjects. We studied subjects the knowledge of which would be required in order to pass a professional examination for commission as Ensign. We tore down and assembled Liberty motors, we learned the name and purpose of each part of the Lewis machine gun, we could disassemble and assemble one in less time than it would take to tell about it. One can readily see that it took a great deal of concentrated effort to assimilate enough knowledge in a period of forty-five days to pass satisfactory examinations on these subjects.

Bud and I were the first two students to complete our solo time in H-boats, and one day we learned that an F-5-L (twin Liberty bomber) was to fly to Washington. Anxious to make this trip, we requested permission to go as second pilots. It was granted.

"You two bozos sure are lucky," said one student upon hearing of our good fortune. "How does it feel to have such a drag?"

"We are just like this with the Admiral," said Bud, holding up his hand with his fingers crossed.

"Look us over," I said haughtily. "You may kiss our hand, providing you wipe your nose first."

"I suppose we will have to kneel reverently as you pass, when you get back from this trip," said another.

It was our first cross-country trip of any consequence, and as we took off Bud was acting as second pilot and I was aft in the radio cabin. Several minutes later a beautiful panorama of Chesapeake Bay lay 2,000 feet below us, and the Naval Air Station and Langley Field, the Army hangout, were becoming specks on the horizon behind us. The scenery gradually unfolded itself below and soon the mouth of the Potomac was to be seen as it spread itself out into the expanse of Chesapeake Bay. Fishing boats looked like pods on the water. On either side of the river were quaint farm houses, each with its narrow ribbon of land running far back into the hills or abruptly ending in a patch of forest. Far ahead off our port bow could be seen a white structure situated on a knoll overlooking the river. On coming closer it took the form of a stately colonial mansion, its lawn, sloping down to the river's very edge, was of the freshest green, its gardens were a mass of colors; altogether it was a picture not soon forgotten.

"That," shouted the radio operator, "is Mt. Vernon."

As the plane passed directly abeam of the mansion, I was nearly thrown to the deck by a series of three zooms. I looked inquisitively at my companion.

"That was a salute to Washington," he said.

All naval vessels when passing Mt. Vernon dip their colors in tribute to the memory of Washington. Airplanes pay tribute in their own original way, by zooming three times.

We circled once over Washington before landing in the river adjacent to the Naval War College. The National Capitol is an impressive sight from the air. The simple white obelisk of the Washington Monument is dwarfed in size but its significance is greatly magnified. The placid Potomac winds through a picturesque valley on the far side of which is Arlington Cemetery and the grave of the Unknown Soldier. The stately Capitol building stands out on the far end of Pennsylvania Avenue, a magnificent creation in white, symbolizing a dignity and respect in keeping with the policies of a great nation.

The return trip was not without excitement. We took aboard an Admiral, and needless to say this did not ease our frame of mind when with thirty miles to

(*Continued on page* 94)

Hangars and slipway at the Naval Air Station, Hampton Roads, Va., as seen from the air.

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The Drag of a J-5 Radial Air-Cooled Engine

By Fred E. Weick

Langley Memorial Aeronautical Laboratory of the National Advisory Committee for Aeronautics.

THIS brief technical article describes tests of the drag due to a Wright Whirlwind (J-5) radial air-cooled engine, mounted on a cabin-type airplane. The observations were made in the 20-foot propeller research tunnel of the National Advisory Committee for Aeronautics. The drag was obtained with three different types of exhaust stacks: short individual stacks, a circular cross-section collector ring, and a streamline cross-section collector ring. The drag due to the engine was found to be 85 pounds at 100 miles per hour with the individual stacks, and 83 pounds at 100 miles per hour with each of the collector rings.

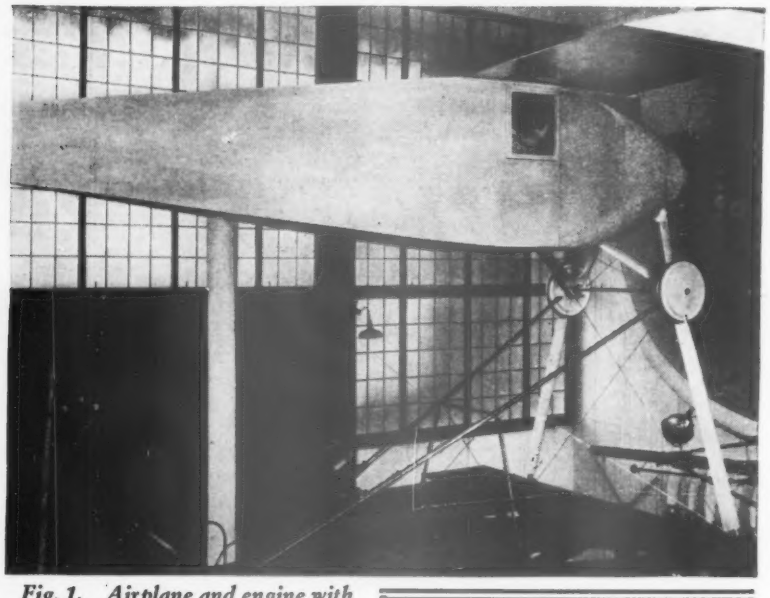

Fig. 1. Airplane and engine with individual exhaust stacks.

At the present time there is considerable interest in the drag due to radial air-cooled engines. In connection with an investigation in the 20-foot propeller research tunnel on the cowling of air-cooled engines, in which a Wright "Whirlwind" (J-5) engine was mounted on a cabin fuselage, it was found convenient to obtain the drag due to the engine. This was done with three different types of exhaust stacks.

The engine with individual exhaust stacks, 1¾ inches in diameter and about 5 inches long, is shown in Figure 1, mounted on the cabin fuselage in the experiment chamber of the propeller research tunnel. The fuselage was 48 inches by 64 inches at the maximum cross-section, and the cowling ended at the mounting ring, leaving the engine practically exposed. A landing gear and a stub wing of 7 foot chord and 16 foot span, having the Göttingen 398 profile, were attached to the fuselage.

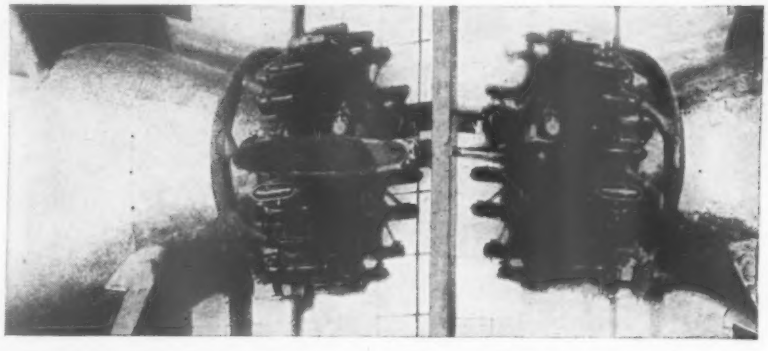

Fig. 2. Engine exhaust ring of circular section.

Figure 2 shows the engine fitted with an exhaust collector ring of 36 inch mean diameter. This ring had a circular cross-section 3 inches in diameter, the exhaust from all nine cylinders coming out on the left side.

In Figure 3, a streamline-section exhaust collector ring is shown on the engine. This was similar to the circular section ring in all respects excepting the cross sectional shape, which was of streamline form, 2 inches wide and 5 inches long. Both rings had approximately the same cross sectional area.

(*Continued on second page following*)

Fig. 3. Streamline section exhaust ring.

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The drag of the installation (without a propeller) was measured with each of the three exhaust systems, at air velocities from 60 to 100 miles per hour. The drag was also measured throughout the same range with the engine removed and the nose rounded as shown in Figure 4.

The observed drag readings for all four conditions are plotted against dynamic pressure and velocity in miles per hour in the table. The difference between the drag without the engine and that with the engine represents the drag due to the engine.

There was a noticeable scale effect within the range of speeds used. The results, which are tabulated below, are, therefore, given for both 60 and 100 miles per hour.

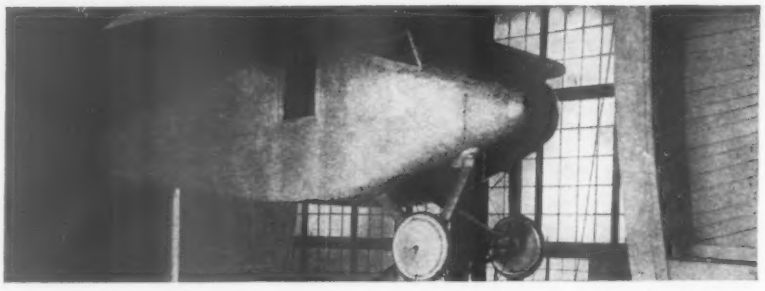

Fig. 4. Engine removed and nose rounded.

Increase in Drag Due to Engine

60 M. P. H.	Drag	$\frac{D}{q}$	Equivalent Flat Plate Area
With individual stacks	33 lbs.	3.61	2.86 sq. ft.
With round section collector ring	31 lbs.	3.39	2.68 sq. ft.
With streamline section collector ring	31 lbs.	3.39	2.68 sq. ft.
100 M. P. H.	**Drag**	$\frac{D}{q}$	**Equivalent Flat Plate Area**
With individual stacks	85 lbs.	3.32	2.66 sq. ft.
With round section collector ring	83 lbs.	3.24	2.60 sq. ft.
With streamline section collector ring	83 lbs.	3.24	2.60 sq. ft.

The results show that the drag was slightly less with either the round or streamline collector rings than with the short individual stacks, which at first thought may appear surprising. It is also somewhat surprising to find that the streamline collector ring, although having a fair strut section and only two-thirds the projected area of the round section ring, had the same drag. However, both rings are in a position behind the engine where they apparently affect the drag very little one way or another. The individual stacks, which are nearly normal to the air flow at the outer portion of the cylinders, evidently increase the drag slightly.

A Network of Weather Stations

THE establishment of approximately 150 weather reporting stations along the 5,500 miles of lighted airways represents the greatest number of surface or secondary meteorological stations yet identified with a single project —the development of civilian aviation. Many of these weather observation stations, maintained by the Weather Bureau of the United States Department of Agriculture, are as yet unequipped with instruments, the surface atmospheric conditions being estimated. Others of these 150 aviation-weather reporting stations, operated by the Lighthouse Service of the United States Department of Commerce, are provided with barometers, anemometers, and ceiling lights.

This network of meteorological observatories—stretching from the Atlantic to the Pacific Oceans—is intended to serve the mission of furnishing airplane pilots with weather conditions at the landing fields, barometric pressures for the correction of airplane altimeters, the ceiling heights at flying fields, and wind velocities and directions. An observer, maintained co-operatively by the Weather Bureau and the Lighthouse Service, is stationed at each of the 150 stations. This system of weather reporting has been interlocked with an extensive radio-communication system—representing a permanent wedlock of meteorology and radio in the interest of promoting the safety of flying.

At a recent conference participated in jointly by the Weather Bureau, the Navy Department, and the National Advisory Committee for Aeronautics, fog was recognized as the greatest foe to the safety of aviation. This problem of navigation is being attacked by Prof. C. F. Marvin, Chief of the Weather Bureau; Captain Emory S. Land and Major C. M. Young of the Navy Department; and Dr. Joseph S. Ames, J. F. Victory and Dr. C. J. Hunsaker of the National Advisory Committee for Aeronautics. The affinity of radio communication and the 150 weather reporting stations along the civilian airways appears to be the most effective agency for combating fog and other adverse weather conditions.

The award of contracts covering radio equipment for twelve radio control stations, six radio beacons and twelve marker beacons to be established on the national airways to the amount of $155,277, has been made by the United States Department of Commerce. The award for radio transmitters for control stations and radio beacons was made to the General Electric Company, and the radio transmitters for the marker beacons were awarded to the Westinghouse Electric and Manufacturing Company. The radio equipment contracted for will be delivered to the Department within six months, and the control and radio stations will be established this winter on the national airways where night flying is required. The installation and maintenance will be under the direction of the Airways Division of the Lighthouse Service.

The radio control stations collect weather information telephoned from intermediate fields along the airways and exchange weather information with terminal landing fields for use of the airplane pilot before starting his flight. After the departure of the plane and while in flight, the control station will keep the pilot advised of any change in weather conditions or landing conditions at the terminal fields along the airway. The radio and marker beacon will provide radio direction for navigating the airplane.

The Airways Division now maintains approximately 20 radio stations on the Transcontinental Airway, giving twenty-four-hour daily service. These stations are gathering points for weather information, telephoned in by weather reporters from critical points and intermediate landing fields. The 150 weather reporting stations, along the 5,500 miles of

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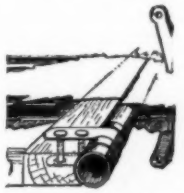
Instead of welded joints in the fuselage, a simple fitting is used which clamps around the longerons. Steel tube struts and braces are flattened at the ends and bolted to this fitting.

Note the simple method of hinging the elevators. The front elevator beam is a steel tube. Simple metal straps slip around this beam with the ends bolted to the rear stabilizer spar.



The main wing beams are of box-type, made of two small beams of spruce covered with plywood as shown below. This type is simple and widely used.

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lighted airways, will probably be furnished with meteorological instruments by the Weather Bureau for reporting weather data according to a uniform system. These reports are turned over to the local Weather Bureau meteorologists stationed at airports and terminal fields for analysis, interpretation, and preparation of local forecasts using Weather Bureau data from its primary net and upper air-reporting stations. Forecasts prepared by the Weather Bureau are transmitted by radio control stations to other terminals along the airways for the information of pilots before taking off. The radio stations transmit other vital information, such as time of departures and arrivals, name and number of pilot and plane, weight of cargo, number and destinations of passengers, pouches and destination of mail, which is necessary for safety and proper dispatch over the airways.

The control stations now planned will further provide for safety of flight by broadcasting at frequent and definite periods by radiotelephone, on 850 to 950 meters, changes in weather conditions along the airways which occur when the plane is in flight, together with instructions to the pilot, should landing conditions at the scheduled terminal airport become hazardous, giving information where to land, together with the landing conditions, elevation of the landing field, and barometric pressure for correction of the altimeter aboard the airplane, the ceiling height at the field, wind velocity and direction, as well as information concerning the arrangements made by the transport company for transportation of passengers, mail, and express from the designated terminal, and what arrangements the company has made for a relief airplane to continue the flight.

Radiotelephone communications to the airplane are expected to decrease appreciably accidents and provide for reliability of schedules with greater comfort to air travellers, and may be considered one of the greatest needs of air transportation today. This service requires that the airplane be fitted with a light weight airplane receiver, which has already been designed by the Bureau of Standards. It is not required that airplanes be equipped with radio transmitters to take full advantage of the service offered, and, therefore, by this system it is possible for small airplanes to take advantage of these safety aids without incurring great expense. For example, radio visual indicators have been devised for airplane instrument boards.

The purchase of radio beacon transmitters and marker beacon equipment is the beginning of the service contemplated by the Air Commerce Act to provide for radio navigation. The radio beacon utilizes the equi-signal interlocking system in which signals are transmitted from crossed loops so arranged that the pilot receives the code letter "A" when to the right of the course, code letter "N" when to the left of the course, and code letter "T" when on the course. This type of radio range beacon must necessarily cover straight sections of airways in order that the radio channel will coincide with the lighted airway.

The marker beacons will be placed at intermediate fields to identify their location for emergency landings. The marker beacons may also be placed at short intervals along crooked sections of airways so as to form a radio-marked channel to the terminal fields, each marker beacon serving as a landmark enabling the pilot to proceed from one to another over known terrain. The same receiving apparatus installed for voice reception can be used for reception of the beacon and marker signals. The signals are transmitted on 950 to 1050 meter wave lengths. The Radio Corporation of America has developed a line of receiving apparatus for this service and especial attention has been given to vibration, noise level and microphonic disturbances existing on airplanes which have been a retarding factor in the application of radio to air transport.

We ask our readers to please remember that in a few months this magazine will be known as Aeronautics—and the name Popular Aviation will not appear. If your regular newsdealer does not carry it, you will confer a favor on us if you will advise us of that fact.

The research work covers special head telephones designed to exclude airplane noises and thereby eliminate airplane deafness, yet not sacrificing the constant knowledge of the operation of the engines, which is accomplished by installing a microphone on the fire wall, permitting the pilot to concentrate his hearing on the operation of the engines at will by throwing a switch. The design of more satisfactory antennae is a problem now confronting the research engineer, which includes the use of a vertical rod instead of the trailing-wire antenna.

It is of importance for proper radio reception, that all airplanes be bonded in the course of construction so as to ground all members. This is comparatively inexpensive if done while the plane is being built, but most difficult and very expensive on the older type of airplanes. The time has arrived when all airplanes should be built so as to take advantage of the radio service to be offered over National Airways for safety of flight. The ignition system should be shielded and special ignition wires used to prevent noises in the receiving apparatus. The Bureau of Aeronautics of the Navy Department, in cooperation with a commercial company, has designed a spark plug which suppresses ignition interference with radio reception.

For blind flying through fog or thick weather the experienced pilot must have a properly balanced airplane that performs true to form, and he should know with certainty that his gasoline supply will carry him to a field that is clear of fog for landing. Landing in fog with safety is not yet an accomplishment. A reliable radiotelephone communication service is essential for safe blind flying in order that the pilot may be kept informed of changing weather conditions and landing conditions. He should be given definite information that the landing field for which he is bound is clear. Bumpy air makes blind flying extremely hazardous; and forming of ice on the airplane wings, which occurs when flying through clouds or fog at temperatures below freezing, makes it impossible as a forced landing, under this condition, is inevitable. The National Advisory Committee for Aeronautics has recommended the use of thermometers on airplanes to solve ice-formation problems.

Visual indicator instruments showing the position of the airplane with respect to radio beacons have been developed by the Radio Laboratory of the Bureau of Standards. Of this type, the reed indicator appears at this time to be the most practicable. The radio transmitters send out signals of definite pitch controlled by tuning forks which are tuned to actuate the reeds of the visual indicator. Instead of receiving an "A" signal when to the right of the course, the left reed vibrates, and when to the left of the course the right reed indicator vibrates, and when on the course both reeds are vibrated to the same extent. There are some advantages in this system, but the one disadvantage is duplication of apparatus required for the radio telephone communication and increased weight. The radio transmitters now being purchased by the Department of Commerce can be converted to transmit signals for visual indicators by the addition of a panel having the tuning fork control. The weather reporting stations, the radiobeacon service, and the instruments on the airplane are intended to operate in concerted action as a means of defeating fog, the terrors of night flying, and the hazards of storms.

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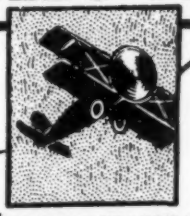

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The Career of Matilde Moisant

As Told by Richmond Pease, Her Manager, to John F. Talbot

I HAD been in the theatrical line for a number of years in a managerial capacity, thereby attaining a fair share of celebrity, when the offer came to me about seventeen years ago to take the management of a company to go through the country giving airplane flying exhibitions.

A form of amusement that then drew marveling multitudes into the fields; an affair of thrills, of breath taking ventures, of dangers immeasurable as thought of then, would today be too familiar to attract paying visitors. The lonely element that up to the beginning of this century belonged to the winged and feathered creation has since become so completely a part of man's dominion that the operation of flying machines is no longer a subject of curiosity and wonder.

I found by this experience that an aviation manager's life is not entirely a happy one. Putting on a horserace is not in it with an aviation meet. Dealing with very expensive and fragile machines, liable at any moment to lie in fragments on the field and representing hundreds, perhaps thousands of dollars of uninsurable loss; dickering with managers of fairs and parks, with chambers of commerce, with boards of trade, and with mayors and chiefs of police for guarantees or privileges without which financial success for such open and aboveboard displays as ours would have been impossible; facing crowds on exhibition grounds and enduring calmly their impatient gibes when weather conditions made flying too risky for even the most daring to attempt; these were among the problems a manager had to solve in the early days. The few months I spent in this work I regard as one of the most colorful passages in a life well filled with exciting episodes.

In the year 1911 there existed in New York an incorporated company, The Moisant International Aviators, A. J. Moisant, President, A. E. Wupperman, Secretary. Its purpose was the building of flying machines and the staging of aviation exhibitions. This company was then maintaining the largest and most complete college of aviation in the world, which was also the only fully equipped and permanently located school of flying in America.

Located on Long Island just out of New York, the school occupied a ten thousand acre tract, with great cement hangars and grand stand; also a large factory for constructing monoplanes was located near. I was employed as superintendent in this factory, building monoplanes of the Bleriot type equipped with Gnome motors.

When the time came to send out an exhibition company its members were chosen from graduates of the school. Among these were Miss Matilde Moisant, Miss Harriet Quimby, Harold Kantner, Jesse Selegman, the Mexican, Francisco Alvarez, and Andre Houpert, the latter a member of the French Aero Clique and head instructor in the Moisant school. It was Houpert's first tour in America. He was the winner of over two hundred prizes taken at aero meets in France; a man of splendid physique, and wonderfully skilful in his profession. Under his tuition Miss Moisant had learned and he named her the most apt of all his pupils.

Miss Matilde Moisant in flying costume.

Two separate exhibition parties started out at first. One under my charge with Kantner as aviator, went south and exhibited at Jacksonville and Tampa, Florida, and Montgomery and other cities in Alabama. The other division, comprising the two ladies and Houpert, Selegman and Alvarez, was sent to cover The Antilles, Central America and Mexico. They met with but indifferent success and considerable trouble all through the Latin-American countries, especially in Mexico, where they encountered real danger from the revolutionists. The Mexican revolution involved one great adventure that can be deemed of historic importance, as the first recognition of the airplane's adaptability for war service. Certain of the Mexican outlaws made overtures to secure the Moisant equipment and the services of the men to drop explosive bombs upon the Federal forces. The reply of Miss Moisant and her companions was that they were not in Mexico for that purpose; that war was not their trade. The insurgent forces began closing in on them in a hostile manner at Torreon, having burned bridges and rendered the railroad impassable for sixty miles outside that city besides instigating the burning of the Moisant grand stand at the aviation field. The issue was joined at once. It was a clear case of science versus force.

The Moisant party held a hurried consultation and in the early dawn started their monoplanes and winged their way out of the beleagured city of Torreon to the railway sixty miles away, where they found facilities to enable them to safely continue their journey to the United States. Not long after this the Moisant company sold five monoplanes to the Mexican government. The foiling of their plans rankled for some time in the minds of the rebels. Threats were made that Miss Moisant would be kidnapped for ransom. Mutterings of that kind even came to me when we were traveling through Texas.

Instructions reached me when this party came out of Mexico to join it with mine in New Orleans and conduct the combined troupe in a tour through this country. It was at the New Orleans meeting that I first met Matilde Moisant. I saw in her a most charming and unaffected young lady, full of enthusiastic devotion to her hazardous profession. There was poetic significance in her presence and intention to fly at the Crescent City just fifteen months after her brother, the famous Johnny Moisant, hero of the Paris to London flight, had fallen to his death on the same field she was to fly over.

The loving cup that had been made ready by the Latin-American club of New Orleans to present to him was awarded to her. The solemnly impres-

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Andre Houpert, Matilde Moisant, and Richmond Pease before the crash at Shreveport.

sive presentation ceremony took place at the St. Charles hotel, in the apartment of the Moisant sisters. General Francisco Altshul, who was to have delivered the trophy to the brother, gave it to the sister in the course of a speech which reflected the sentiment of the Latin-Americans who knew Johnny Moisant and loved him. The cup is one of the most magnificent ever designed by New Orleans silversmiths. It is sixteen inches from base to brim and bears an inscription to the fearless sky man dated January 1st, 1911.

"We cannot say just how much we appreciate this loving cup," said Miss Matilde. "We are unable to find suitable words to thank our people here for this lovely gift, but it will always be near and dear to us. There will ever live in our hearts love for the givers. This cup is one of the few mementoes of our loved and lost brother that remain to remind us of him. When our car was robbed on the way here from Laredo a number of articles that belonged to John were taken. That makes this token seem more precious."

To be ready to make repairs after accidents it was necessary to carry with us nearly a car load of parts. On the way to New Orleans the car was plundered of nearly all of our materials, causing us much delay in our opening.

On Sunday afternoon, March 12th, 1912, in New Orleans, Matilde Moisant in her Bleriot monoplane thrilled several thousand spectators by her spectacular flights and daring evolutions in the air. She made two flights. In the last one she rose about 3,000 feet and a moment later was a mere speck in the blue sky as she sailed away toward the place where Johnny was buried. In passing over she dropped a floral wreath on his grave. Returning she came gracefully to earth only a few feet from where she started.

At the close of the successful meet at New Orleans we proceeded to Shreveport to give exhibitions under the auspices of the Fair Association. It was in a pouring rain that we arrived. Matilde greeted the friends who surrounded her with the sprightly remark, "They do call us birds, but we're not ducks." Answering some inquiries she stated that she obtained her license to fly at Mineola after taking 22 lessons. She was the second woman in America to be licensed, Harriet Quimby having preceded her by 13 days. Her license number, 44, was up to that time the total number issued in America. She is described as a charming little woman, with a beautiful olive complexion, and a swift, brilliant smile. In a manner devoid of any sign of posing she talked of her air conquests and adventures interestingly and ardently. Her sister Louise, also a handsome woman, and her devoted companion, lived in constant terror while Matilde was in the air. She would not even look at a flight, so fearful was she that she might witness her sister's death.

"We have been out at the fair grounds to brush the cobwebs off the sky," said big, jolly Brueggerhoff, Secretary of the Shreveport fair, breathing a prayer for fair weather during Saturday and Sunday, for the aviation meet. The weather did clear and exhibitions were given on those days. That Sunday afternoon thousands of terrified spectators had the great thrill of their lives in witnessing the narrow escape of Miss Moisant from destruction. She had been up about 3,000 feet in a splendid flight, but in swooping down to alight on the race track, near an automobile where a few of her friends were standing, the plane touched the ground at a dangerous angle. There was a knoll and small embankment where it struck. This caused one wheel to strike with extra force; the other wheel if it hit at all struck lightly. The machine bounded diagonally thirty feet in the air. The motor had been cut off and the plane instead of rebounding evenly, tipped and then turned completely upside down.

The occupant, jolted from her seat by the first shock, managed to keep her balance until near the ground, when she fell, landing on her hands and knees. A second later the great fabric fell on top of her, completely hiding her from the horrified witnesses. The right wing and propeller were broken and also the right landing wheel. Had it not been for the iron wing supports that stuck in the ground and held up the heavy parts, the girl must have been crushed to death. As it was she wriggled from under the wreck unhurt save for a scratched and

An admission fee was charged for entrance to the big circus tent which served the Moisant troupe as a hangar.

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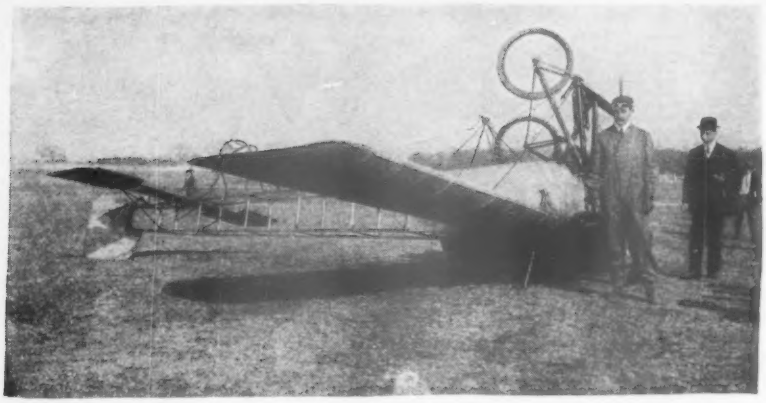


After the accident at Shreveport.

blackened eye where her goggles had pressed against it.

She sprang lightly to her feet laughing, and evading the help of those who rushed to her aid, hurried to where Louise sat to prove her safety. A few minutes after the accident she merrily approached Houpert saying, "I'll make another flight this afternoon, professor, if you'll lend me your plane." At a sign of dissent from me he shook his head in refusal. "And just think," she sighed, as she regretfully watched the removal of the wrecked monoplane, "I wore a green suit this afternoon in honor of St. Patrick's Day." The scene ended in a rush of souvenir snatchers seeking splinters from the shattered propeller.

The next place after Shreveport was Dallas, Texas. The engagement was under the auspices of the Dallas Park Board, Eugene L. Pike, Chairman. Other official sponsors were Mayor W. H. Holland, Messrs. Kiest, Dealy and Anderson, of the three Dallas newspapers, C. E. Linz, President of the telephone company, and W. G. Crush, of the combined railway service. The aviators named were Matilde Moisant, Andre Houpert, Harold Kantner and F. Alvarez; Richmond Pease was the manager. On the handsome souvenir program the cover showed the smiling face of Miss Moisant, who was mentioned as the first woman in America to operate an airplane.

Intense public interest was shown in her first flight on the first day of the meet. As her plane rushed across the field and rose smoothly into the air a hush fell upon the crowd, but when she rounded the turn and headed north the spectators cheered mightily. She flew around at a height of about 3,000 feet a goodly length of time, and glided down gracefully to the landing place to receive the hearty plaudits of the assembly. In reply to questioners she answered, "No, I was not afraid; when I am I'll quit flying. Mr. Houpert told me he thought it was too windy, but I didn't want to disappoint the people. Tomorrow I think I can go higher than I did today."

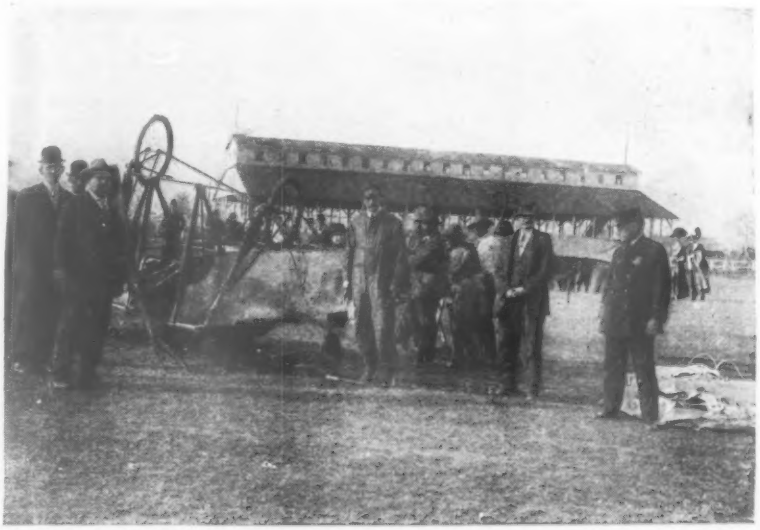
On March 23rd, 1912, she sailed into the clouds above Dallas in the initial flight of the international meet, attaining distinction as the first woman aviator to fly in Texas. Mr. Pike said, "Never have I seen a prettier flight, and I have seen a lot of them." Speaking of the disappointment shown by the crowd early in the afternoon owing to the flyers' delay in going up, Matilde smilingly said, "Flying is not like taking a walk; we have to take notice of the weather." Unfortunately the remainder of the meet was broken up by rain and soggy ground. No person was more disappointed thereby than Miss Moisant.

In that idle time waiting for good weather I learned from her many details of her adventurous career. "I do not believe in stunts in the air," she told me. "There is no sense in dips and dives when a person must know that the time must come when a crash must end it all. I think I first became interested in flying the day my brother came from France bringing his monoplane. I became very enthusiastic, but after his death I grew to hate the word aviation. When the school opened the old love came back, and it was a race between Miss Quimby and myself.

"At the international meet at Nassau, L. I., in a contest with the well known French aviatrix Mlle. du Trieu, I was awarded the trophy for the world's altitude for women, 3,000 feet. Since then I've really been 10,000 feet up. It was in Mexico, where I rose 2,000 feet above the President's palace; and Mexico City is 7,500 feet above the sea level. It was my hardest climb, as I found the air very thin up there."

She learned to fly in three beloved and nick-named machines — "The Goat," "Guinieveve," and "Detroit." She is one of the few American women who hold the distinction of originating a fashion. She designed her own aviation costumes, for there were no models for feminine wear in the new profession. Her costume consisted of knickerbockers in one piece, with severely plain shirt-waist, high laced boots, gauntlets, a cap to cover her curls and nape of neck; and goggles. She had three suits; one dark green corduroy, one maroon, and a third of the color of the fatigue uniform of the army. "Ciel blue and rose tints that women dote upon are left for me only in the shimmer of the sunset when my plane sinks to earth on a lonely field some day at sundown," she said once. "I believe in 13 most seriously; I was born September 13; took my first flying lesson July 13; got my pilot's license on

Pease and Houpert with the wreck of Miss Moisant's plane at Shreveport.



When You Step into the Cockpit to Solo

What will guide you — Luck or Good Training?

A young man goes through the routine of his primary training. With his instructor he banks and turns, he climbs and dives. He makes landings and take-offs and learns the "feel of the plane."

Finally after permission from his instructor he is ready to solo. As he nervously steps into the cockpit calling "Contact" what do you think will help him most? Luck? He needs a far safer assurance than that.

Suppose luck guides him through his first solo. After that, will it keep guiding him?

Just a few hours training in a privately owned plane will not make a flyer. A real pilot needs thorough training in every branch of aeronautics. He must know aerodynamics to know why his plane obeys different controls and to know how his plane reacts under different conditions.

He must know of the stresses imposed on his plane in different maneuvers—he must know plane mechanics and the construction and design of his plane.

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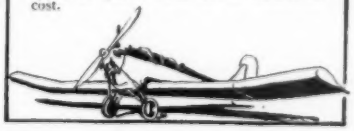

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my birthday, September 13; and weighed 113 pounds the day I made my first professional ascent in the air.

"Shall I ever give up flying? Yes, certainly, in about two months. It's terribly fascinating, but my sister"—who was in the room bending over her embroidery while this conversation was going on—"becomes almost a physical wreck every time I go up. Then I shall learn to drive an automobile. Queer, isn't it, that I should never have driven a motor car on the ground before I tried it in the sky? Except for rowing or horse-back riding I never attacked athletics strenuously. It doesn't take much strength for sky motoring—more nerve than anything else."

In five short months, comprising her rapid spectacular career, she gained international fame as an aviatrix. As an illustration of this it is worthy of note that in every place we exhibited, whether for a day or a week the finest automobiles were placed at her disposal by dealers anxious to enjoy the prestige afforded thereby.

The next city on our itinerary was Tyler, Texas. The meet was under the auspices of the Commercial Club, augmented by the entire force of the city and county government. We had a guarantee and it was up to them to protect it. The third of April was the opening day. Miss Moisant made the second flight and ran into a novel adventure. When sailing at her greatest height, about 2,500 feet, she met a flock of wild geese flying north on their annual migration. When the leader saw the great and terrible-looking invader of the sky, flying so swiftly and uttering noises he had never heard before, he gave a loud squawk and turned his flock away to escape the enemy so utterly beyond his ken. The retreat of the flock gave fervent relief to the other party, as an encounter with the flock, while certainly disastrous to the geese, was almost sure to be equally so to the attacker.

Here is a description of the single seater monoplane flown by Miss Moisant: weight about 1,000 pounds, of which the motor acounted for 170; length 28 feet; wing spread 32 feet; seven cylinder Gnome rotary motor; revolutions 1200 p. m.; propeller 8 feet across. The landing gear was very frail in comparison with those in use now. We had a large tent we used for a hangar, to which we charged an admission fee.

For the Tyler meet there were ticket boxes at every approach to the flying field, and any person found on the field without a ticket was treated as a trespasser and liable to pay court costs much greater than the price of admission. There were officers on foot and horseback to protect the approaches and also the machines on the field. Oh, they took aviation seriously in those days. Of course the supreme attraction was the fair Matilde, who gave successful performances both days of the meet.

The time for her final expeditions into the sky was drawing near. Yielding to the entreaties of Louise and the express wishes of her brother, she decided that her next exhibition, which had been arranged for Wichita Falls, Texas, should be her last venture into cloudland. As fate ordained it, this excursion narrowly missed being her farewell to the world from whose surface she so often had soared lightly and slipped safely back.

The Moisant company had a standing offer of $5,000 to any one of its flyers who should wrest from the famous

Miss Moisant standing beside her Moisant-Bleriot monoplane.

Frenchman, Roland Garros, his record of the highest altitude. Miss Moisant, holding the prize for the highest altitude for women, was anxious to gain the Garros trophy, and it was thought she might make the effort at Wichita Falls.

Late in the evening of April 14th, 1912, at Wichita Falls, Miss Moisant took off for her final flight. The engagement had been most unsatisfactory. For four successive days the high winds prevented flights. During the fifth day the winds continued sweeping great clouds of dust across the ball park, but the crowd patiently lingered, hoping the gale would die down toward night. It was nearly sunset when Houpert managed to get into the air and made a splendid showing lasting about fifteen minutes, in which he ascended about 4000 feet and traveled about fifteen miles.

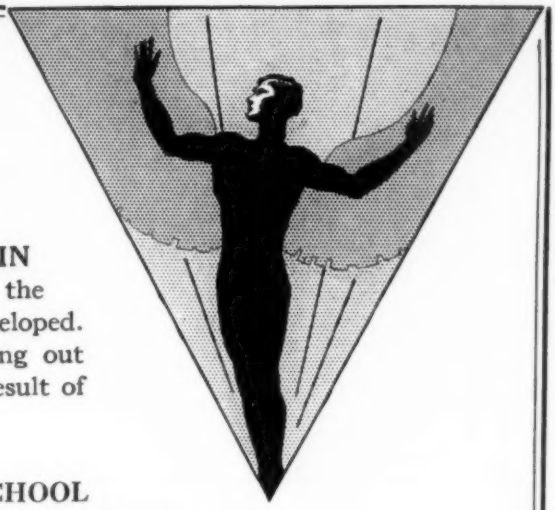
Miss Matilde then appeared. It was nearly seven o'clock and growing dark when she came out in attractive costume and took her seat for what she had announced as her last flight. Approaching darkness had caused most of the spectators to leave. The thirty mile gale had died down to a gentle breeze, almost a calm. Matilde decided to reward the patience of those who had waited so long. In a sweeping evolution she mounted to about 2500 feet, flew around for several minutes and finished amid the hearty cheers of the people. Enthused with the purpose of giving those who had waited so long in the wind and dust storm their money's worth; disregarding the protests of her sister, her instructor, and her manager, she sent her monoplane whirling up from the shadows into the sunlight, where it flashed silver-bright, soaring like a bird. In about ten minutes she came down, looking for her starting point, but coming swiftly from the bright light into the gloom she seems to have miscalculated the distance. The plane struck the ground with great force and bounded high upward. Several spectators had rushed forward expecting the craft to remain on the ground. To avoid crashing down among them she started the motor, but it failed to carry the machine upward. Shooting forward about a hundred feet it struck heavily and again bounding up, pitched forward, the propeller blades splintering as they struck the earth. One piece tore a hole in the gasoline tank and the liquid burst into flames that covered the machine almost instantly.

The girl had attempted to jump before the crash, but her feet caught and held her. Spectators shuddered and turned away from the awful tragedy that looked inevitable. Luckily, owing to our precaution of keeping close watch over her landings, I was near and so was Houpert and an elevator boy from the hotel, named Roy Condon. Just as the flames reached her Houpert seized her and dragged her out. The three of us worked swiftly. I pressed her face down into the sand so her features should not be marred from her burning clothing; the others beat out the fire with their hands and she was saved. Her leggings were scorched and her curls where they peeped from beneath her cap, were singed. No other harm was done. The machine, the same one with which she had had her mishap at Shreveport, was a total loss. An instant's delay on the part of her rescuers would have been fatal to the daring young woman.

The following day Miss Matilde and her sister, in obedience to a telegram from A. J. Moisant, left for California. Never again was she to tempt fate in the upper air. It was said that she was almost lured from that promise by the fame Miss Quimby, her only rival, gained by flying over the English Channel. She wanted to do something equally sensational, but friends argued her out of the notion, and

(*Continued on page* 93)

Look to the Sky for Your Future



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Lighting as an Aid to Safety

By F. C. Hingsburg
Chief Engineer, Airways Division,
U. S. Department of Commerce.

NIGHT flying is essential for successful air transportation operations in the United States as the basic source of revenue is the transportation of air mail and express. The Civil Airways are established under present policies to serve the requirements of the air mail routes and schedules. The economics of present air transportation requires the gathering of mail at the close of the business day and transporting it to remote destinations for early delivery on the next or successive business day. Airway lights have been installed on more than 7,500 miles of airways and 4,000 additional miles are being lighted during the fiscal year ending June 30, 1929. The present program includes the completion of the Transcontinental lighting system from Salt Lake City to San Francisco. Upon the completion of the lighting a double mail schedule will be established. Mail collected at the close of the business day on the Pacific Coast will be delivered on the Atlantic Seaboard in the first mail delivery on the second day after posting, the mail having traveled two nights and one day on its journey from coast to coast. Close connections with feeder routes will make this service available to 69,000,000 people through 109 air mail stops at commercial centers. This fast transportation system will be an important factor in the exchange of ideas, enlargement of the scope of business activity, and creation of a better understanding of our national problems.

Night flying, although it has been carried on successfully by air transport companies, is more hazardous than day flying. This is due to poor visibility, imperfect observation of weather conditions by the pilot and difficulty with which the extent and severity of storms may be determined, and the prevalence and rapid formation of fog and change of weather conditions at night. To reduce these hazards, the Air Commerce Act authorized the establishment of airways equipped with air navigation facilities. The airways are selected to follow the route offering the best flying conditions between the designated airports and are provided with intermediate landing fields approximately 30 miles apart to provide safe landing places under conditions of stress of weather or mechanical troubles. One company flying 1,500,000 miles had 420 forced landings due to adverse weather and 55 due to mechanical and other difficulties. A forced landing due to impossible flying weather was made for every 1,350 miles of flight and a forced landing due to mechanical or other reasons for every 27,000 miles of flight. The air navigation facilities consist of route markers and landing field markers for day flying, an airway lighting system for night flying, a weather reporting and forecast system under the Weather Bureau, a communications system for the exchange of weather and other information over the airway, radio direction for the guidance of airplanes over the lighted airway and radio telephone communications to aircraft in flight. A high per-

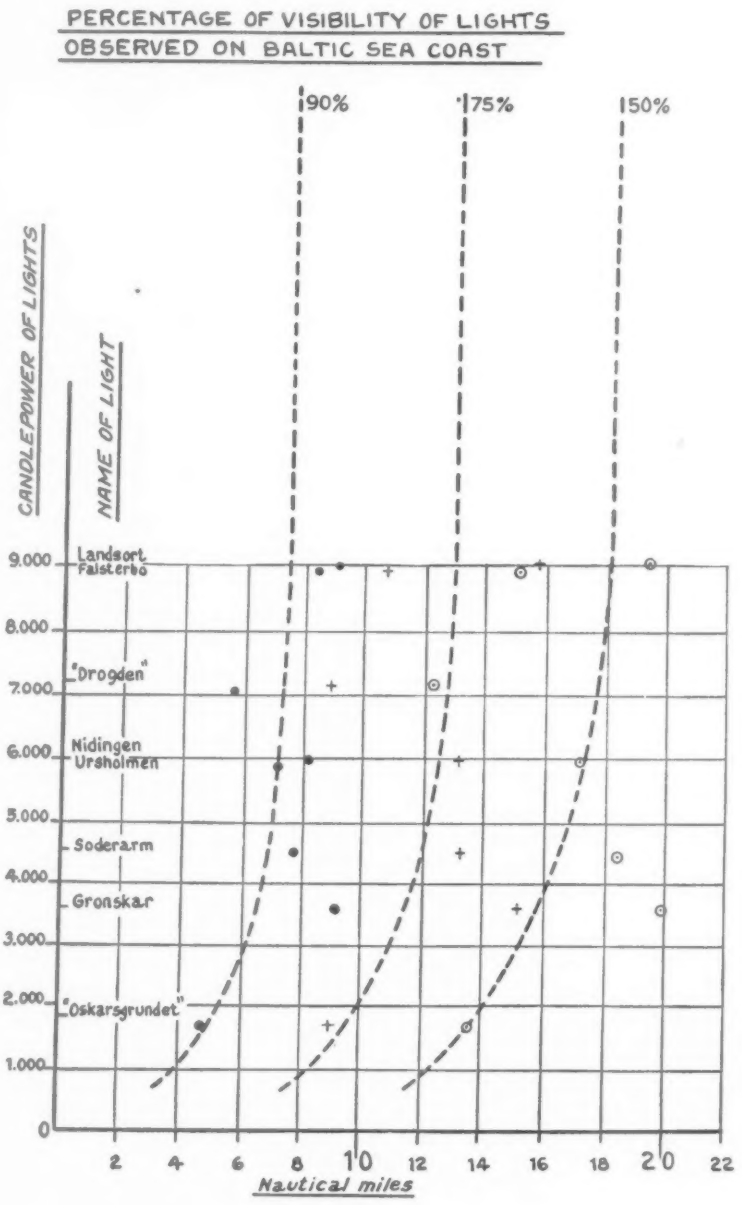

Fig. 1. Observations of the visibility of lights along the coast of the Baltic Sea.

Piling up the Proof

November 10, 1928.

Mr. Walter H. Beech, Pres.,
Travel Air Manufacturing Co.,
Wichita, Kansas.

Dear Mr. Beech:

The splendid day to day performance of the Travel Air biplanes in Parks Air College, as revealed in a recent recapitulation of our flying log, may be of interest to you and I give you herewith some of the high lights of the record supporting a conclusion to which I have long since arrived. Namely, that Travel Air makes the finest, safest and sturdiest commercial airplane now in production anywhere.

Since we began operations on March 21 at the Parks Airport, in the St. Louis Metropolitan District just south of East St. Louis, we have purchased 39 ships from your company. Some of them we have used in our training program and others we have sold. At the outset we used four ships in our flying school, today as I write this letter there are 19 of your OX-5 jobs on the line and in the air. It goes without saying that these ships and the others we have used have taken a terrific amount of rough handling at the hands of our students, particularly in the early stages of their training. Since the early part of the past summer we have at all times had more than 200 men in our flying classes - today for instance, we have 229 so that you can understand that the ships are kept in the air during all the daylight hours. In addition, some of them have been used for night flying since the installation of our flood lights.

I find on going over our log that from March 21 to October 30 our ships flew a total of 6,535 hours. Approximately 48 percent of the time was taken up by solo students, yet during that period we have had only one crack-up, a minor one in which the repair bill was $650.00. That represents our sole crash expense. Our only injury has been a fractured finger suffered in starting an engine.

During that period there has not been a single structural failure. Undercarriages, which come in for a major share of beating on training work, have stood up perfectly. During our most active month, July, we piled up the total of 1,351 airplane hours flying time without a single forced landing. Since we began our operations forced landings from all causes totaled only 21, or less than 1 to every 300 hours. It is interesting to note that we did not come upon Travel Air by chance. We have tried other ships and found them wanting. All in all we find that Travel Air is not only the sturdiest ship we can find but the most maneuverable, the safest and the one most suited for all around training work, not only for airdrome flying but for the cross country travel with which our students are graduated.

Yours very truly,
PARKS AIR COLLEGE, INC.
Olivia L. Parks
Vice President.

O.L.Parks-GB

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centage of night flying efficiency coupled with safety will require the combined use of all these facilities, properly coordinated.

The establishment of a lighting system for clear weather visibility is comparatively simple. Under such conditions the patterns of city lights and stray lights are beacons of the first magnitude, but under adverse weather conditions the stray lights lose their characteristics and become confusing, competitive lights. The airway lighting system should be designed for poor visibility flying. The beacon light should have an optical design that utilizes the greatest percentage of light flux from the light source, concentrating the light into a high intensity beam of candlepower in excess of competitive or stray lights, and project the beam into the sectors most useful to the pilot. The light should have a distinctive characteristic so as to be recognized instantly among the stray lights as a light of aeronautical character and should have individuality so as to be recognized as a landmark of known geographic location. The durations of flashes should be sufficiently great to develop the maximum luminous value on the retina of the eye and the luminous period and frequency of flashes should be proper to fix the location on the horizon. The lights should be spaced as close as availability of funds permits.

The determination of the proper light intensity, power import, and spacing of lights is a complicated economic and scientific problem. One of the factors involved is the penetration of lights through the atmosphere under varying degrees of poor visibility. Figures 1 and 2 show an interesting study of comparison of light penetration on several coasts, corresponding to 90% visibility under ideal conditions of relative darkness. A thirty-five mile light on the East Indian Archipelago is reduced to a five mile light in Dover Straits. It is interesting to note how the curves coincide for short ranges and the relatively low candlepowers required for two mile visibility. Reduced to the needs of air transportation having a flying efficiency of 96 to 98%, much higher candlepowers would be required to meet the conditions under which air navigation takes place and the competition of stray lights of high candlepower in thickly populated regions. This was demonstrated by the inadequacy of the three mile spacing of low candlepowered acetylene lights installed by the Post Office Department. The 200 m/m unit with one foot burner developed about 120 candlepower. Aeronautical lights should have candlepowers in excess of 1,000 but the close spacing was correct in principle.

Based on the results of economic studies it was determined that the best average results were obtained by using a 24 inch revolving beacon of two million candlepower with identifying courselights spaced ten miles apart along the airway. The lights are mounted on a skeleton tower, as shown in Figure 3. Commercial power is used where available, but otherwise duplicate gasoline driven generating plants of 2 KW capacity furnish the current.

Ten lights of this character are established to each block of one hundred miles and code numbers are flashed on the courselight projectors, giving the mileage location along the airway. Red courselights are used as beacons where no landing fields are located; yellow courselights are used at beacons on intermediate landing fields. The lights are elevated to show the greatest candlepower to the pilot when he is flying above the adjacent beacon at a height of 500 to 1,500 feet.

The latest design of 24 inch revolving beacon is shown in Figure 4. The light from a 1,000 watt, 110 volt, T-20, Airway lamp is concentrated by a parabolic mirror into a beam of two million candlepower having a 4° beam spread. The front cover glass has prisms on the inside surface which deflect some of the light upward from 0° to 25° that the pilot will not miss the beam by flying too far above it as he approaches over the airway. A half drum lens is mounted as a saddle on the drum, gathering the light, otherwise

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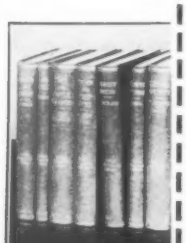

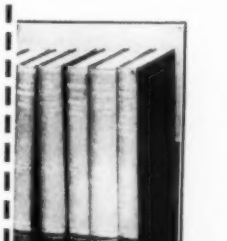

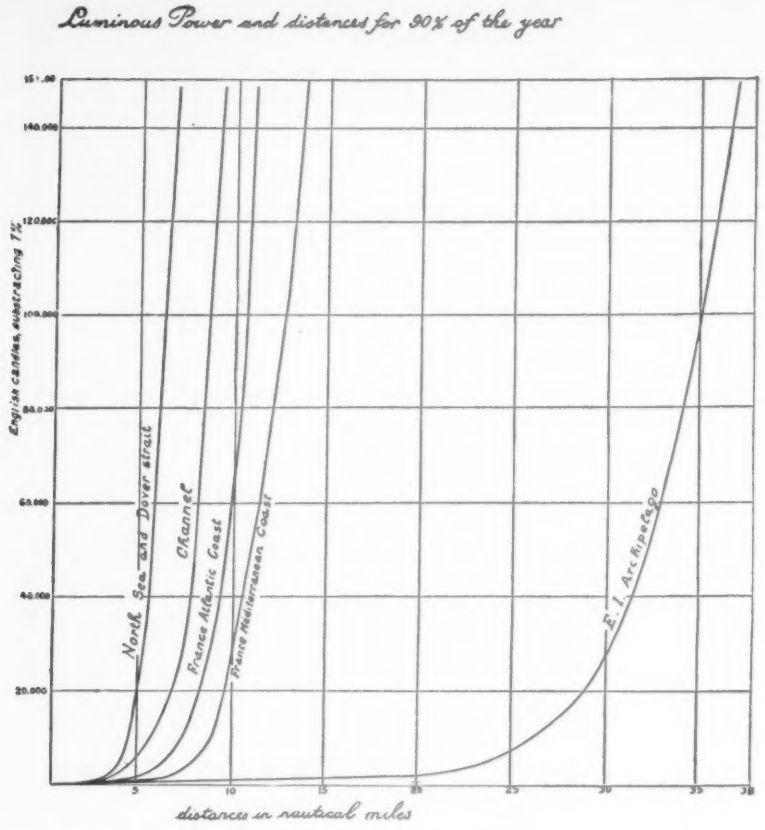
Luminous Power and distances for 90% of the year
English candles subtracting 1%
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distances in nautical miles

Fig. 2. Relative visibility of lights in eastern and western waters.

lost, into a fan-shaped beam of light showing from horizon to horizon perpendicular to the axis of the main beam. As the beacon rotates, secondary flashes of 12,000 candlepower are shown 2½ seconds before and after the principal flash and are decidedly advantageous at close range, especially in thick weather.

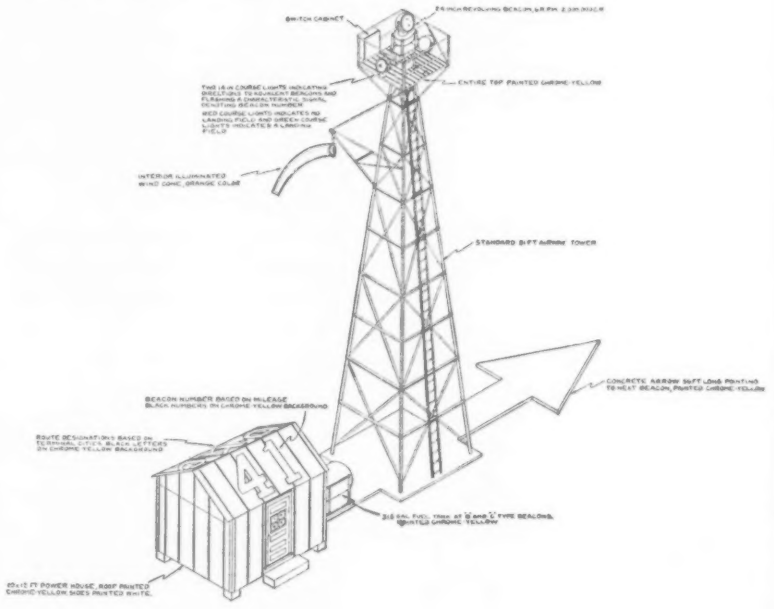
A courselight of entirely new design using doublet lenses and horizontal spread light mirror is also recommended. The lamp used in this unit is a 500 watt, G 40, 110 volt monoplane filament lamp of 800 hours life, and develops 165,000 candlepower with 15° beam spread.

Another new addition to the list of optical apparatus of the Airways Division is a flashing code beacon. The lantern is a 300 m/m double unit with two light sources using 200 watt, P S 30, ring filament lamps of 1,000 hours life, both lamps burning simultaneously. The flashing code beacon is used for marking major obstructions along airways, and also for intermediate airway lights, where power is available, and for marking intermediate landing fields located off the airway, in a valley or obstructed from view of adjacent beacons, in which case an airway beacon is located on high ground and has yellow courselights to show the availability of the landing field.

Intermediate landing fields are marked by an airway beacon with yellow courselights and the landing area is outlined by boundary cones and lights spaced approximately 300 feet apart. Red obstruction lights are mounted on all obstructions. Green range lights in the boundary system mark the best approaches and runways. The wiring diagram of a typical field lighting system is shown in Figure 5. An internally lighted wind cone is mounted on the beacon tower. Ceiling lights are installed at intermediate landing fields at which weather reporting stations are located. The ceiling light is a 14 inch projector, as shown in Figure 6. The light is projected at an angle of 63°-26′ above the horizon and the height of the ceiling is measured by a ceiling height indicator.

The maintenance of airway lights through isolated and sparsely inhabited sections presents a serious problem. To meet this situation an improved acetylene route beacon was developed by the Airways Division. It combines the highest development of railroad signal practice with marine range lighting system and is applied to airway lighting in a new and unique manner. Two lanterns are used, one being mounted above the other. The top lantern is an azimuth and off courselight, having a separate flasher, piping and gas supply, showing 40 flashes per minute of 180 candlepower. The lower light is a courselight of 15° beam spread and 5,000 candlepower flashing 20 times per minute. The lower light is a double ended range light lantern having 18″ bull's-eye lenses with 10″ doublet lenses. This acetylene apparatus offers the greatest degree of reliability with its dual lanterns, each with separate

Fig. 3. Typical mounting of a 24 inch revolving beacon.



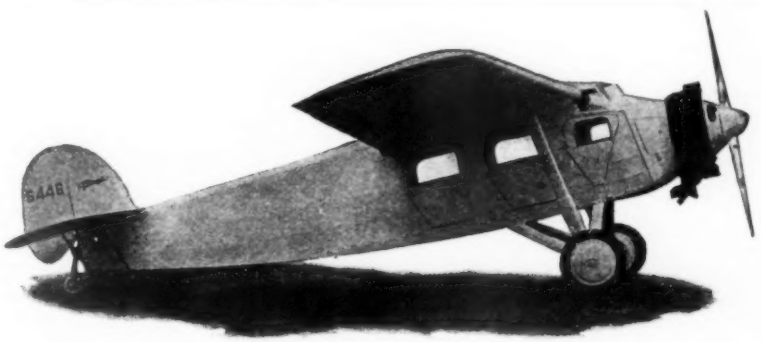
mechanism and gas supply, and its automatic features enable its installation in isolated localities for operation without attendance for periods of six months or more. These lights will be spaced three miles apart. They bring within the realm of possibility, close spacing of lights of adequate candlepower, luminous period, and distinctive aeronautical character at a cost of installation and maintenance comparable to electric lights at ten mile spacing.

Where a revolving beacon of two million candlepower is picked up by a pilot at thirty miles, the acetylene range light of 5,000 candlepower will be visible thirteen miles. Under conditions of fair visibility when a revolving beacon is seen ten miles, the acetylene range light is visible five miles. On a thick night when the pilot advances five miles beyond a revolving beacon, before he picks up another revolving beacon five miles ahead of him, the acetylene range beacons will be visible from light to light at three miles spacing.

Airways are laid out over the safest low level routes providing weather landing fields 30 miles apart, preferably following habitation, roads, communications and power, and reconciled to the installation of lighting and radio aids. A high percentage of completed trips on schedule time is essential for the success of air transportation and the combined use of lights and radio direction is essential to meet this requirement. For safety the radio marked airway must coincide with the lighted airway, the pilots making use of all facilities and traveling the same routes in bad weather as on clear nights. When lights are not visible one to another, radio direction takes the pilot over the airway, enabling him to catch a glimpse of lights and fields at close range and this combination of blind-contact flying will increase the flying efficiency with the greatest degree of safety. On the Transcontinental Airway 15 radio-range beacons are required to mark the lighted airway from coast to coast. The radio-range beacons will be erected at the center of straight courses and radio mark 50 to 150 miles of airways in opposite directions.

Once established and checked the radio marked course will be permanently fixed so that the edge of the radio-range will cut on definite landmarks and never be shifted. This requirement will develop the greatest confidence in blind flying by the pilots. At the change of course and at intersections of airways, great confusion would result due to interference of the overlapping signals if all beacon signals are transmitted on one wave length, and to meet the situation about 6 channels separated by a frequency of 5 KC are required. Each beacon should also be identified by its individual characteristic. This winter will see nine radio-beacons in operation on the Transcontinental, marking lighted airway courses. Five individual characteristics suitable for the interlock equisignal range beacon will be used for identifying the beacons. Visual indication appears to have great possibilities when developed to meet operating conditions involving a number of radio-beacon installations with overlapping ranges. Radio direction is the subject of a paper by another author and is introduced here to show its inter-relationship to lighted airways from an operating point of view.

Careful consideration has been given in the design and construction of structures and equipment to reliability of service for the safety of air navigation. Lamp exchangers are used to guard against lamp failure and duplicate engine-generators are installed where power is not available. Electrical work is placed in waterproof conduits according to the National Underwriters Rules and underground cable is lead incased and armoured with underground connections made in waterproof boxes filled with insulating compound. Apparatus is rugged in construction and efficient in operation. Airway mechanicians are assigned to about 200 miles of airways and thoroughly inspect and overhaul all apparatus at least once a month. A fleet of 40 trucks is used for transportation and to carry



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spare parts for all apparatus so that immediate replacement of any defective apparatus may be made. The general supervision of airways is under the direction of District Lighthouse Superintendents, and Airway Engineers assigned to these offices supervise the maintenance work. (The lighted airways receive the same attention, following the same policies and practices used in administering the great work of the Lighthouse Service.)

Close cooperation exists between the Air Transport Companies and airways personnel. Arrangements have been made on all lighted airways for daily pilot reports covering the operation of lights. Airways mechanicians communicate each morning with Air Transport representatives for pilots' reports and defects reported by pilots are given immediate attention. Local notices to Air Transport Companies and to the aeronautical public are issued covering all changes in aids to navigation and these changes are published in the Domestic Air News.

Steps have recently been taken to equip an airplane for the quarterly inspection of all airways and landing fields, for the purpose of certifying to the aeronautical public the adequacy and safety of air navigation facilities. The crew will consist of a pilot, radio engineer and airway mechanician and the airplane will be equipped with radio transmitter, receiving equipment and testing instruments. The pilots will be experienced in night flying and expert on airways and landing field requirements. The radio engineer will check up on the communications service and radio direction as well as communications to aircraft. The airway mechanician will check up on the proper focus, elevation and proper operation of lights and equipment. By landing in each field, by day and by night, and checking up on the service rendered by each airway mechanician and radio communications station, a thoroughly efficient organization will be assured and safe airways maintained.

Privately established aeronautical lights are certified as to their adequacy by the Department of Commerce under the Air Commerce Act. The airways lights established by the Department and the majority of airport lights are revolving beacons and this type of light has been developed and characterized as aeronautical lights. Lights established on an airway are given characteristics similar to airway lights, revolving 6 R.P.M. and elevated about 1 degree above the horizon. Rotating beacons that are not located on an airway revolve 2 R.P.M. and are elevated 15 degrees or more. Private advertising lights that serve a useful aeronautical purpose must establish a landmark from which a departure can be taken to reach a landing field or must mark a landing field. Unfortunately, great demands are made for the establishment of revolving beacons for purely advertising purposes that do not serve the best interests of the pilot. Most of these lights are not certified or authorized. The establishment of a great number of advertising lights of aeronautical character leads to confusion and destroys the value of true aids. Before authorizing and certifying private aeronautical lights, the local aeronautical interests and air transportation companies should be requested to submit their reports and recommendations as to the purpose served by its establishment. Proper attention to these matters will prevent the establishment and certification of improper lights. The Air Commerce Act authorizes the discontinuance of any false light or signal at such place or in such manner that it is likely to be mistaken for a true light, and private lights that prove a menace should be reported by pilots so that steps may be taken under the law for their discontinuance, after proper investigation.

Under agreements made between the War Department and the Department of Commerce aeronautical lights and markings are required on transmission lines and other structures built across navigable waters of the United States. The towers of transmission lines are required to be painted alternate bands of chrome yellow and white separated by narrow black bands and the towers marked with red obstruction lights. The electric code

(*Continued on page 93*)

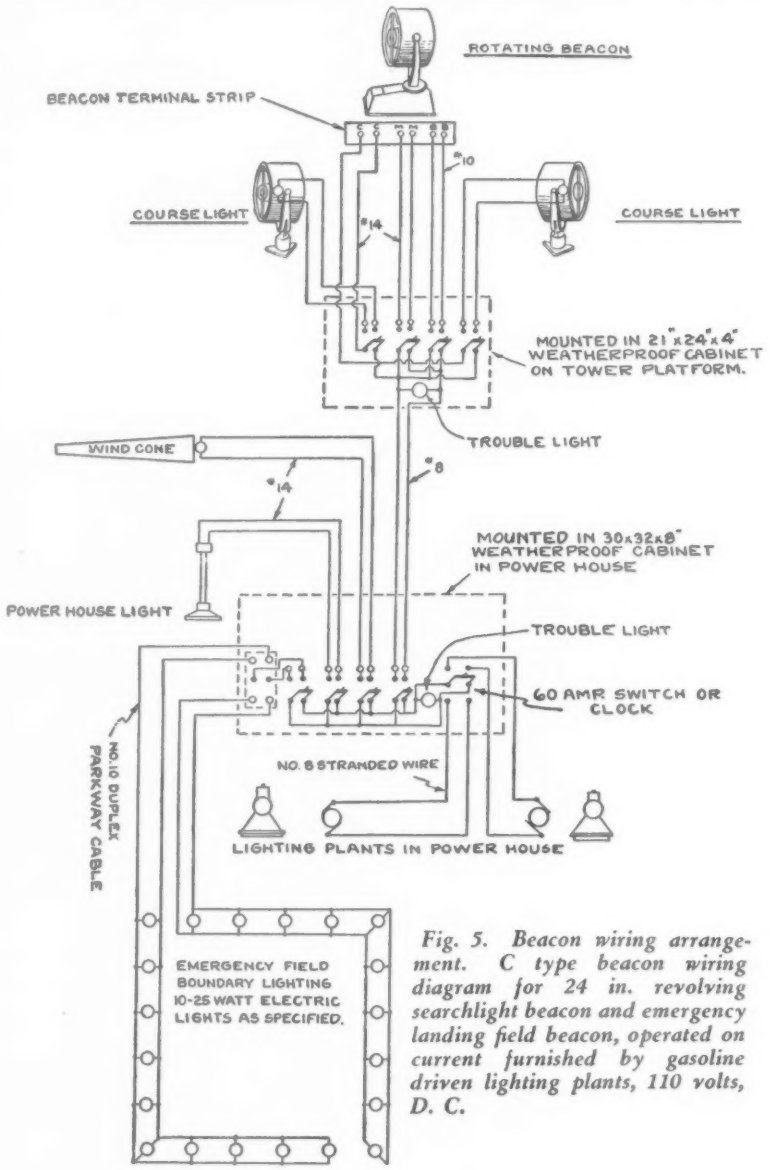

Fig. 5. Beacon wiring arrangement. C type beacon wiring diagram for 24 in. revolving searchlight beacon and emergency landing field beacon, operated on current furnished by gasoline driven lighting plants, 110 volts, D. C.

Pros and Cons of Installment Selling

By William W. Luftig
Pacific Finance Corp.—New York

THE cloud that has hung over the system of selling merchandise on installment is gradually disappearing. It is no longer considered a disgrace to buy goods "on time." It is becoming the accepted method for selling such goods as are adaptable to this type of distribution. However, the opposition and hostility has not entirely vanished. Denunciation of the system of installment selling comes largely from bankers who see in its growth a corresponding reduction in savings that would otherwise go into the banks or in investments; from manufacturers who are too short-sighted not to move along with this new merchandising trend in selling; by manufacturers and dealers who are being outdistanced by their competitors; by manufacturers who cannot use this method of merchandising because the product they manufacture does not lend itself very well to installment selling; and by dealers who through competition or necessity use the system but are not sold on it.

The opponents of the system condemn it in the most emphatic terms. They see only disaster facing the country. They claim that the system was a measure forced upon the country at the close of the war by manufacturers whose home markets were oversold and whose foreign markets would or could not buy its goods. The solution was installment selling. An orgy of time payment spending swept the country. The system is enslaving the people by piling them up with debts. Thrift is no longer held up as a virtue because thrift does not fit in with installment buying. It has made us a nation of spendthrifts, encourages extravagance and has led to our buying goods we can well do without. The people are spending their earnings through purchasing goods on installment credit. The system has led to a dangerous inflation; is but an artificial and temporary stimulus to business and the prosperity we have been enjoying has been unreal and fictitious.

They see a reckoning in store for this unwise and uneconomic inflation of credit with ruin for those who sell goods on installment and gamble on receiving payments for the goods sold. They consider it a gamble to depend on the purchaser's ability to keep his job and his health. Should the purchaser lose either one or the other the chances of receiving payment are sharply reduced. During a period of depression and unsettled business conditions purchasers of installment goods will be unable to pay for goods from future income or salaries as yet unearned. A period of depression with corresponding unemployment will also bring along a reduction in the production of those goods that are primarily dependent on installment selling.

They are also certain that the large "mass" production plants will lie idle and overhead expenses will continue to pile up with probable failures. Banks

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might even be threatened with insolvency because of their rediscounting of finance company paper which is obtained from installment houses. The system has increased the cost of living, brought on higher prices and has materially increased the purchasing of luxuries at the expense of the necessities of life. Because the cost of installment goods also includes the finance charge, people pay more for the goods and therefore buy fewer goods and industry in general loses. These are the "cons."

Conclusions drawn from insufficient and inaccurate facts and from wrong premises lose their significance and importance when proved to be wrong. There is no real cause for the hysteria. The cataclysmic opinions given above, the skepticism and the gloomy forebodings of the future are not supported by facts and statistical conclusions. The installment facts refute installment fancies. The conclusions of the opponents of the system are limited to individual experiences in local areas and when examined closely the indictment is rather against certain abuses of the system than against the system itself.

Some rather detailed and comprehensive surveys have been made on the subject of installment selling. Scientific study has been somewhat limited by not having really authentic statistics of all the classes of goods sold, but in general the surveys have covered the entire country and all the industries concerned. Many individuals, business houses and banks have made their own studies, but the outstanding reports are from the American Bankers Association who made their study from the viewpoint of the financial and economic interests of the country; the National Association of Finance Companies who made their study from the standpoint of the sellers of installment goods, and Prof. Seligman's scientific survey. The conclusions of the many independent surveys and studies that have been made are remarkably uniform in nature and are contradictory to the conclusions of the opponents of the system.

Regarding the prediction of those opposing the system that in a period of depression installment buyers will renege on their payments and throw back on the sellers and the finance companies the goods sold to them, the exponents of the system point out that there is no basis for believing that installment obligations are any different from any other obligations; or for thinking that contracts and fixed obligations will not be met just the same and that installment credits necessarily mean frozen credits. Neither is there any basis for assuming that the next period of depression will be prolonged on account of the installment selling of the present.

It is true that the best judge of how the system will function during a period of depression and unemployment is to have it pass through such a crisis, but the experiences of the past and the conclusions based on the recent studies are to the effect that installment selling will be too small a factor either way in causing or aggravating a business depression. Wages and salaries are the mainstay of installment selling and during a trade depression the decrease in employment is never more than ten per cent. below the average employment. Furthermore, a depression never comes without its warnings and unemployment usually comes not directly with the period of depression but some time after it.

Not all industries suffer alike during depressions and although installment buying will undoubtedly decline in volume during such a period, there is no reason to suppose that the decline will be serious. During the depression period of 1914, the losses to installment sellers were not above normal, but installment paper at that time was small in volume. However, during the depression period of 1920-21 when this method of selling had assumed a commanding position in industry, the losses were only about normal. During 1925-26 while the Pennsylvania coal strike was on, the entire mining region was affected and the losses were very little above normal. The experiences of business houses who have used this method of selling merchandise shows that they weathered all periods of business depression with insignificant losses.

Numerous surveys fail to show any grounds for asserting that installment selling has increased prices. Commodities bought on the installment plan have declined in prices in the past few years due to the fact that mass production has brought cheaper prices. The cost of living has increased only seventy-five per cent. over the pre-war period, while our wage scale has risen about one hundred and twenty-five per cent. The difference has gone into savings and spendings. During 1920-1926 there has been only a slight increase in the general average of prices, and last year despite an increase in the volume of installment sales, living costs declined on an average between five and six per cent.

In summarizing it is safe to conclude on the basis of widespread and numerous surveys and studies that have been made, that installment selling has made for general business prosperity. It has made possible in industry generally the production of goods on a mass scale and it is undoubtedly true that "mass production" could not have occurred without installment selling. It has made possible a tremendous volume of retail sales, stimulated and steadied production and reduced prices on installment goods. It has led to greater employment, higher wages, has leveled off seasonal periods; flattened the production curve and has decreased the summer buying slump. It has put new life into industry in general and has been a direct means as an aid to our prosperity. It has elevated the standard of living. Coincidently with the increase in installment buying there has been an increase in saving bank deposits and in the number of depositors. There has also been an increase in investments, in the number of building loan associations and in the number of their members. All of which shows that the American people have been using installment credit conservatively and wisely.

Comments on Installment Sales

POPULAR AVIATION AND AERONAUTICS recently asked several of the leading airplane manufacturers of the country to express opinions concerning the desirability of selling airplanes on the installment plan. The reactions of these men to the suggestion implied by the question were of considerable interest. In general, installment selling seems to be thought of as a sure but possibly somewhat tardy development. The airplane market at the present time is in a highly favorable condition and the incentive to apply additional pressure to demand that is already almost embarrassing is for this reason slight. Until airplanes can no longer be sold easily and readily on a strict cash basis, the manufacturers naturally prefer to continue the present methods of disposing of their products.

Another point to be considered is the very reasonable reluctance felt by manufacturers in all fields, including the automobile field, to directly engage in installment selling. The situation in the airplane industry, as was pointed out in an article by Robert S. Clary on Retail Selling Methods in our January issue, is quite similar. Many manufacturers favor the adoption of installment selling methods by their distributors, particularly in localities where competition is sharp, and the potential market is good. Certain manufacturers definitely encourage this practice. But practically without exception, the airplane manufacturer feels obliged to leave this to be arranged between the distributor and a finance company, without actively participating on his own account. For the buyer of airplanes this simply means that if it is desired to spread the payments over a period of time, such transactions must be arranged privately with the airplane dealer, or a note must be negotiated.

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AVIATION is waiting for no one! Too many millions of capital are already invested —the demand for air service of *every* kind is increasing too fast. Aviation demands men who KNOW. Men who can DO. Men who can step into the real jobs and command the real salaries. Plane production today is *ten times* what it was a year ago. And a year from now it will be twenty times what it is today! Landing fields, municipal airports, plane and equipment factories, air mail and passenger lines, service and sales organizations—all are leaping ahead in the fastest, most amazing development that any industry has ever known. In such racing, feverish activity, *where* is there any room for a man who has nothing to offer? An empty pocketbook is no drawback—but Aviation has no place, no patience, no *time* for empty hands or empty heads! Aviation is taking-off for the greatest non-stop flight in history—and the men who will go along and climb to the top are the men with a foundation of FACTS under them.

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Walter Hinton was pilot of the famous NC-4, first plane to fly the Atlantic; he piloted the first plane from North to South America; he was first to fly to the headwaters of the Amazon. During the War he was a crack flying instructor for the Navy. Today—with a course that experts agree is the most complete and practical ever produced —Hinton is training keen-sighted men for the Big Pay jobs in Aviation.

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To succeed in Aviation—make BIG MONEY—you need not necessarily be a pilot. There must be many thousands of pilots, certainly. But for every plane that flies, there's an immediate need for trained men in more than *forty* different important jobs on the ground. Construction, motor and instrument experts—airport managers, service foremen, salesmen—all make *real* money. Some of them even bigger pay than pilots earn. But every last one of them must have the FACTS. Today's problem—YOUR problem—is to LEARN Aviation *quick*. And right there is where Walter Hinton is achieving the biggest success of his career.

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A Forced Landing

By Lady Heath

TWENTY-six aeroplanes entered for the International light aeroplane competitions in France last September. Twenty-six little machines of all types and shapes and nationalities.

Some crashed, some got tired, some got lost and only four finished up the 2,000 mile reliability tour of France. My little Avro Avian equipped with a Mark III Cirrus engine, now being made in this country, was one of the fortunate four, but it was only by repeated luck and extraordinary hard work that we persuaded it to get round.

After we had finished with take off, landings, climb, speed, petrol consumption, and all other troubles that make an international competition we were forced to wander around France to show that our poor little overworked hacks could tour as well as perform.

In the dim gray dawn two French fishermen came with their nets to investigate the Moth.

The next to the last lap of the tour was from Nantes to Le Havre, a distance of about 200 miles. We had to carry our full load on the machines in the shape of sand bags and the pilots on the tour consequently felt rather hot-and-bothered at the thought of piling in their kit as well. A beautiful solution presented itself, and I sent to England for my privately owned Moth to accompany the tour carrying the spares and suit cases of all the competitors with an amateur pilot, a friend of mine, at the joy stick. We called it the "Cheval de bagage."

I had a little carburetor trouble at Bordeaux and so decided to exchange my carburetor with that on our baggage hack. This was speedily effected at Nantes. There was no time for petrol tests or re-arrangement of jets as a prize was given at Le Havre for the first machine in, so one had to start at the crack of dawn, after working half the night. My mechanic was a wonderful worker.

I put my sand bags in front and on top of them I had one of the keenest and most enthusiastic passengers I have ever had the pleasure of traveling with, Mr. John Webb, one of the foremen of the company which makes the English Cirrus, who had come as my mechanic as every French town was giving the pilots so many public receptions that we had no time to work on our own aeroplanes. "Webbie" is not a pilot himself but he knows more about engines than most people I know. I always look on it as a great compliment that he trusts me in races and competition, and all sorts of difficult situations, to keep his skin whole.

We were flying into a strong wind and were making slow time as we passed over the beautiful towns and forests of Mayenne with blue lakes shining between them. Our petrol consumption seemed to me horribly high. We had evidently left the feed far too rich. My indicator needle was dropping with alarming rapidity. I did not worry much as the farther north I went the more beautiful were the forced landing fields that spread out before us. When we got as far on our route as Bourguebus I realized that I would just have too little gasoline left to take me into Le Havre and so I turned to Caen where there is a combination of town, river road and railway and where we hoped to get the best fuel possible.

We just got to the edge of Caen when the petrol supply failed us and we scrambled down into a field by the road leading northwards into the town. Naturally, the excitement was intense, and in five minutes the machine was surrounded by hundreds of small children of all shapes and sizes.

Webb and I shook hands. We always shake hands when anything of interest happens. I don't know why—it brings us back to the normal probably. Then, we proceeded to cajole the most intelligent French child to go to the nearest garage and buy us a lot of "Essence." The "Essence" duly arrived in gallon tins and we filled up, realizing it was very bad motor fuel but it was all we could get. Having done this and cut down our petrol consumption a bit we persuaded some of the local police to keep the children at bay and we took off out of our little field. On we went to our destination with a beautiful guide beneath us, the River Orne and the Deauville coast line. We flew low along the level sands waving as we passed to crowds of bathers and little fishing boats near the shore.

At Trouville, we turned directly North and went out across the estuary of the Seine. The other side was somewhat obscured by mist although it was but 10 short miles. I thought it advisable, having precious Webb on board, to climb high for safety. Thank goodness we did.

When we were five miles out to sea with Trouville's numerous sand castles and bathers behind us with its hundreds of bathers disporting themselves in the surf, and the piers of Le Havre before us beginning to take definite shape, suddenly there was a crash, a bang, and a clatter and instinctively the nose went down and we turned back towards the land. We had luck. The engine died, but occasionally it caught a few revolutions that pulled one nearer to that safe white line of surf on the shore.

The bathers, the sand castles and the striped umbrellas made Trouville beach gaudy and terrifying. In the line of the

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that Parks Aircraft, Inc., the new $2,000,000 manufacturing corporation, will give every student who enrolls during January 1929, a position in turn as pilot when he graduates and receives his Limited Commercial License!

There are no strings to this offer. Pilots are vitally needed. They must be obtained or production must slow down.

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And in addition to flying, a pilot must know aerial navigation, meteorology, aerodynamics; be familiar with such famous engines as Whirlwind, Caminez, OX5, Velie, Wasp and others. You must know how to take care of your own ship! All this is included at Parks Air College! Every student, regardless of the class of license he is trying for, receives training in **all ground subjects** necessary to qualify for a Transport License!

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On February 1st, all prices go up! Don't miss this opportunity to save over a hundred dollars on your training and guarantee yourself a job when you graduate. Alert, wideawake students will leave **at once** for Parks Air College and start their training that practically guarantees success.

If you have never visited our school, never seen our catalog and do not know any graduate who can give you full information — then wire at once for a free copy of "Skyward Ho!" our inspiring catalog that gives all information about our courses and answers all your questions.

DON'T WAIT

But delay will cause you to miss this golden opportunity. You must be in school **in January** to get the special rate and be sure of a job when you graduate. **Opportunity knocks**—is here—and gone! Leave at once for Parks and success, or wire immediately for "Skyward Ho!"

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We filled up with gasoline in the little field. Webb is in the foreground.

surf we had water that was too shallow for the bathers and too wet for sand castles and the Avian sat down in it, the starboard wing missing a little old lady complete with her knitting, by a hairsbreadth. We shook hands again! By a marvelous stroke of luck there appeared on the scene a high official of the French Air Ministry, complete with summer flannels, full of good advice, and he dashed me to a telephone to get in touch with Le Havre while the faithful Webb proceeded to trace the trouble. We found that the terrible motor fuel we had put in had seriously damaged a piston face, and a ring had broken and chewed up everything in the neighborhood.

Soon the baggage Moth appeared in the skies replete with the spares I had telephoned for, but what was our horror and chagrin to see it miss us and sail right over our heads and proceed to look for us miles further down the beach. I wish you could have seen Deauville Beach at that moment. The French high official recruited all his friends and they had gathered an army of small children to flatten out every miniature castle and hollow in one section of the beach, and we marked it out as an improvised aerodrome with towels and newspapers.

Further back was my Avian, under whose wing French hospitality had spread us a luncheon of vin blanc, long French rolls and some sliced ham.

We worked like ants taking everything to pieces. Suddenly the baggage Moth caught sight of us, and glided down to a perfect landing near us on the cleared sand. Webb waved me aside as soon as he got his new pistons and cylinders. It was impossible for two people to stand up on the rickety chair which was our trestle and so I employed myself taking our hosts up for joy rides in the "baggage Moth." Even the French high official let his family go up when he saw that it had come down once safely. It made me very happy to find that a rival competitor had taken the Moth as its "driver" could not be found, and, with true sporting spirit flown the spares and some good gasoline over to me.

We worked until the faint stars come out, and a crescent moon rose in the dark blue sky and then we hauled the machines above high water line and fastened them down for the night.

The sun had just come back to the countryside of France next morning when we tackled the cylinders again and at six o'clock the last nut and bolt was screwed down and the Cirrus was ticking over with her old monotonous regularity.

The tide was out that morning and its path made a wonderful natural flying field.

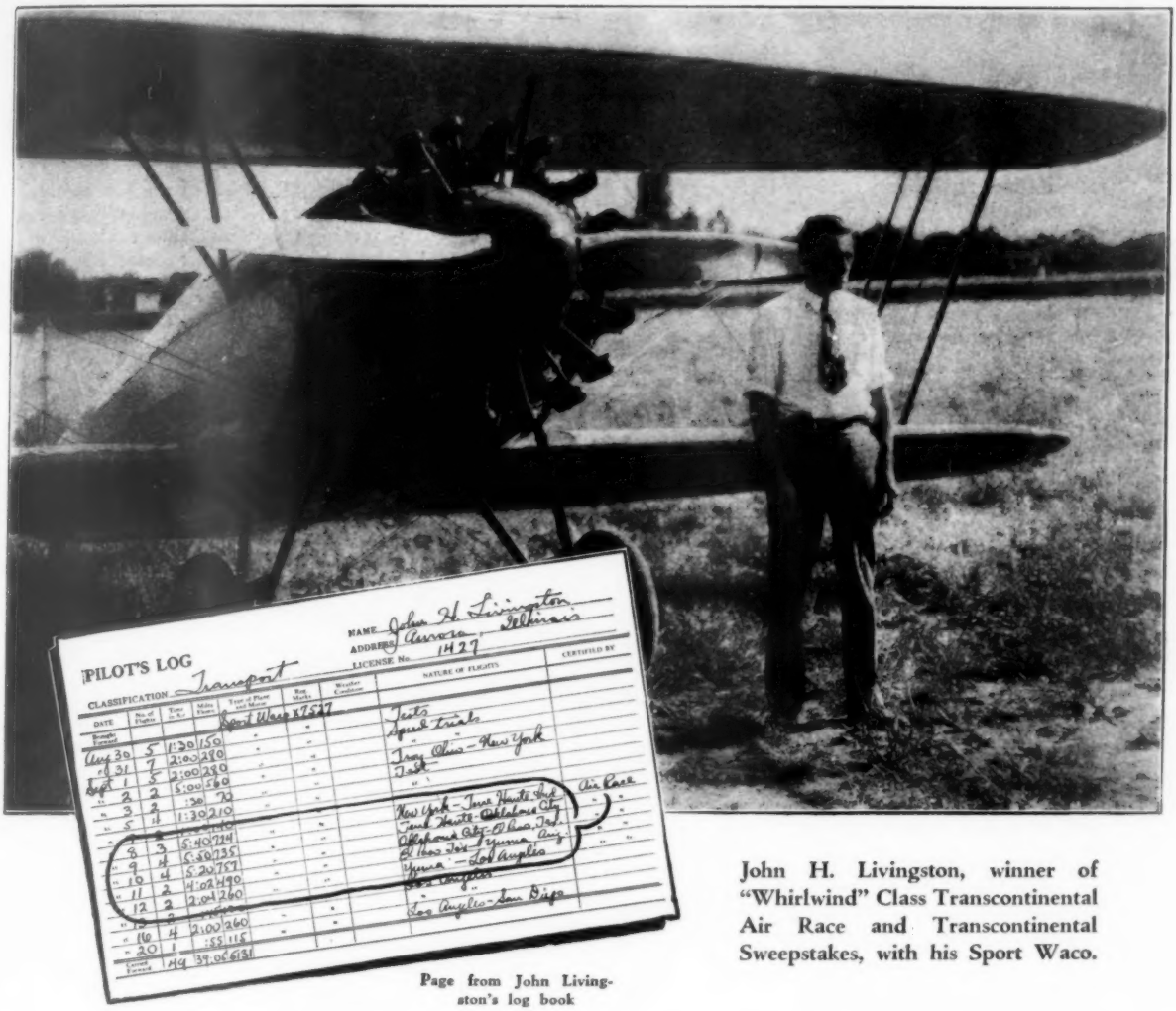
Very gingerly we ran her up chocked up with gasoline cans and although she was down in revs a little, she was fairly steady. We climbed and circled about the beach for a quarter hour before we ventured across the estuary. The faithful baggage Moth did the tour as reliably as any of the competition machines hovering kindly in the near foreground.

We touched ground at Le Havre at five minutes past eight. The aeroplanes were all ready to leave on the day's lap at eight o'clock and had to check in at the end of the day's journey by four, so that we had a simple matter before us to do the 200 kilometres into Paris where the competition ended.

Never shall I forget that journey. Racing along the valley of the Seine over water and forest trying to make good time, and every moment when a single revolution was lost going through the pangs of another forced landing!

Well, she got to Paris and there we gave the unfortunate little engine a top overhauling, a better one than we had given her overnight on the beach. Without any exaggeration we took a teaspoonful of sand out of the petrol filter and another teaspoonful of aluminum filings out of the oil pump.

A high official of the French Air Ministry came to our rescue in beautiful white flannels.



Page from John Livingston's log book

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"The Sport Waco's exceptional maneuverability, together with its quick take-off and slow landing speed, puts it far in advance of similar planes being flown at the present time.

"My log book shows a total of 10,291 miles covered in my Sport Waco, at an average cruising speed of approximately 130 miles per hour. These figures, in my opinion, constitute an excellent record for a commercial plane."

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To our great surprise the final French reaction was one of entire unconcern. One would think that strange damaged aeroplanes floated in out of the sky, to their beaches and among their bathers every day of the week.

That is the right way to treat Aviation. It should be taken as a matter of course.

The most distinct recollection I have, gliding in towards land over that water, with the engine spitting and misfiring and finally stopping, and with a hundred holiday makers before me and the wet wet water underneath, is the sight of Webb's face in the front cockpit. He had pulled his cap off, and he had his arms up on the decking to protect his face if we hit anything hard, but he had an utterly unmoved expression, a complete poker face, —but—a pure white complexion with a green tinge, and a crop of hair that in spite of the rushing air, was standing up straight and stiff and terrified.

Praises be that his premonitions were for naught.

Service Notes

THE current Air Corps News Letter records the election of 2nd Lieut. J. B. Burwell to membership in one of the most exclusive of Air Corps fraternities—the Dumb-bell Club. Membership in this organization is limited to those who have exhibited exceptional ability to perform unusual feats in aircraft. Previous nominees have been proposed for achievements such as taking off from Kelly Field for Dallas due north in the morning, and landing at dusk 60 miles southeast of Kelly out of gas, falling out of an airplane 1100 feet in the air for no apparent reason, and similar extraordinary deeds. Air Corps officers whose names appear on the banner of the organization are:

Major C. J. Browne (deceased).
1st Lieut. R. L. Maughan.
1st Lieut. Max F. Schneider.
Major R. C. Candee.
Captain John I. Moore.
1st Lieut. Y. A. Pitts.
2nd Lieut. L. S. Jamieson.
1st Lieut. A. Thomas.
1st Lieut. B. B. Cassiday.
2nd Lieut. J. B. Burwell.

Lieut. Burwell is the most recently elected member of the club, succeeding Lieut. Cassiday as the custodian of the banner, an honor Lieut. Cassidy had held for six months. Lieut. Burwell hit a mule hitched to a grass-cutter on the flying field. The following is the official citation:

"Officers of Kelly Field:

"We meet on this auspicious occasion to do honor to a brother officer, a man who has distinguished himself far above all expectations. We are here today, gentlemen, to bestow upon him the highest honor that Kelly Field can give—an honor next only in importance to the Congressional Medal of Honor and the Distinguished Service Cross. Before making this esteemed award, it will be necessary to review the facts and circumstances that caused the Committee on Awards to bestow this honor.

"On the bright and sunny day of October 23, 1928, in his trusted DH, this intrepid Air Corps officer was cruising about the ozone of Kelly Field when, feeling a little frisky and being a quick-thinking pursuit pilot, he decided to engage in a little combat work. As it was during the noon hour, he could find no planes in the air to frolic with. He cast his eye about the sky and terrain for a suitable prey for his pent-up enthusiasm. His attention was finally attracted to a two-mule-powered single-place grass attacker piloted by an Ethiopian field officer, which was flying at a very low altitude and at a very uncertain speed in the vicinity of the 43rd Squadron airdrome. Our brave hero licked his chops and, turning to his mechanic, said: "Watch me down the Quartermaster Air Force." Pushing his throttle forward, he made one of those terrific dives so common to the quick-thinking brigade. The Ethiopian pilot, seeing that he was being attacked from his right flank and being sadly outclassed, took to his parachute. However, one of the mule powers of the motor, seeing that escape was impossible, decided to put up as good a fight as possible. He elevated his tail to an angle of 45 degrees, brought back the bolts of his rear guns, and as the DH got within range let fly, hitting the plane in a vital spot and causing it to careen over on its side and fall to the ground a mass of flames.

"Fortunately, the hero who had risked his life beyond all call of duty, who was so enthralled with the desire to give his Corps the supremacy of the airdrome, and who without thought of personal safety engaged an enemy far superior to himself in equipment, escaped the fray with only bruises and burns, and has now completely recovered and is with us today.

"Lieut. James B. Burwell, it is with the greatest pride that I bestow upon one who is so fearless, so courageous and so self-sacrificing, this little honor, and with the unanimous approval of this body of officers select you as a permanent member of the Dumb-bell Club and custodian of our sacred banner, the Dumb-bell Flag."

A recent memorandum issued by the Chief of the Air Corps, Washington, D. C., outlines the procedure to be followed in the selection of Air Corps officers for assignment to activities or specific duties. As a rule, requests for orders effecting changes of station of Air Corps officers will be submitted to the Adjutant General in advance of the effective date of the orders, as follows:

When being ordered to, or relieved from, Service Schools—6 months.

When proceeding to, or returning from, foreign service—5 months.

When being relieved from, or ordered to, other permanent assignments—3 months.

Exceptions will be made in the case of officers pursuing the pilots' course at the Advanced Flying School, the Balloon and Airship School course and Service School courses of less than 6 month's duration, when orders will be requested not less than 30 days prior to the completion of the courses.

The Personnel Division will maintain lists of eligible applicants for courses at the various schools. These lists will be referred to the interested Divisions of the Office Chief of Air Corps not less than two weeks prior to the date orders are requested, and the interested divisions, together with the Personnel Division, will select the required number of officers from the list according to their eligibility and availability.

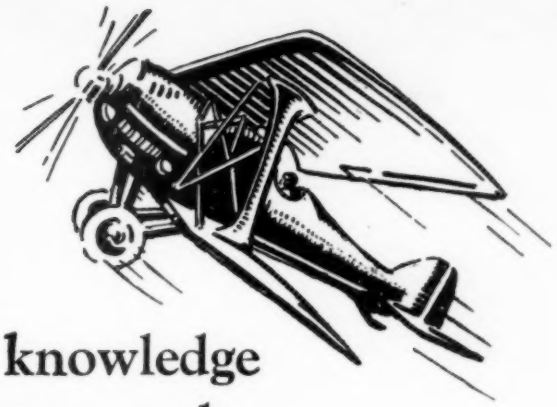
The War Department has recently awarded the Distinguished Flying Cross to 1st Lieutenant Oakley G. Kelly, 3rd Pursuit Squadron, and 1st Lieutenant Carl B. Eielson, Air Corps Reserve, U. S. A. Lieut. Kelly received the decoration at Camp Nichols, P. I. The award was made by the Commanding General of the Philippine Department, Major-General Wm. Lassiter, who was accompanied by Governor-General Stimson. Lieut. Eielson's decoration was awarded for the part Eielson played as pilot of the plane which carried Capt. Sir George Hubert Wilkins across the Arctic from Point Barrow to Spitzbergen last spring. The citation accompanying this award reads as follows:

"Carl B. Eielson, first lieutenant, Air Corps Reserve, United States Army. For extraordinary achievement while participating in an aerial flight. Lieutenant Eielson as pilot, accompanied Captain George H. Wilkins (an English subject), from Barrow Point, Alaska, to Dead Man's Island, Archipelago of Spitzbergen, on April 15-16, 1928, without stop, a distance of more than 2200 miles. The severity of the weather, the storm area through which they passed, the impossibility of safe landing en route with nc hope of outside aid in case of a forced landing, and the complete success of the enterprise, distinguished this as one of the most extraordinary aerial accomplishments in history.

Residence at enlistment in the Army on January 17, 1918, at Fort Omaha, Nebraska, given as Hatton, North Dakota. Birthplace and permanent address given as Hatton, North Dakota."

Captain St. Clair Street of Wright Field, Dayton, Ohio, is also a recent recipient of the Distinguished Flying Cross.

Data on the previous educational record of the eighty-five flying cadets who entered the Air Corps Advanced Flying School at Kelly Field, Texas, November 5, 1928, to form the present class, indicates that a very high type of student appears to be characteristic of the personnel of the Advanced Flying course. Of the eighty-five cadets reporting for training, 30 were college graduates, 40 had had two years or more of college but had not graduated, 12 had had some college work, 1 was a graduate of the United States Military Academy, and 2 were high school graduates only. The average age of these men was 24.3 years.



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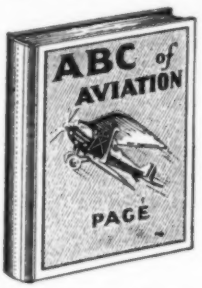

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Kill Devil Hill, Kitty Hawk, N. C.

International Civil Aeronautics Conference

AMONG the outstanding aeronautical events of the year 1928, the International Civil Aeronautics Conference, called by the President of the United States at Washington, D. C., December 12th to 15th, 1928, rightfully deserves an important place.

The Conference provided a fitting close to the first quarter century of aviation progress throughout the world, and was called at a time to coincide with the commemoration of the Wright brothers' achievement.

In response to President Coolidge's official invitation, which was extended to all the nations, the powers of the world designated men of outstanding achievement in aeronautics to be their delegates and to participate in the Conference.

The following countries were represented at the events in Washington: Austria, Australia, Belgium, Canada, Chile, China, Colombia, Costa Rica, Cuba, Czechoslovakia, Denmark, Dominican Republic, Esthonia, Finland, France, Germany, Great Britain, Greece, Guatemala, Hungary, India, Irish Free State, Italy, Japan, Mexico, Netherlands, New Zealand, Nicaragua, Norway, Panama, Persia, Poland, Serbia, Croatia and Slovenia, Siam, Spain, Sweden, Switzerland, Turkey, Venezuela, and the United States.

The following were the official delegates to the Conference:

Austria

Eugene Hauenschield, Counselor of Legation.

Australia

Lt. Col. H. C. Brinsmead, Controller General of Aviation, and Capt. G. F. Hughes, president, New South Wales Section, Australian Aero Club.

Belgium

Emile Allard, Chief Engineer and Director of Technical Service, Aviation Department.

Canada

G. J. Desbarats, Deputy Minister of National Defense; W. W. Cory, Deputy Minister of the Interior; P. T. Coolican, Assistant Deputy Postmaster General; Wing Commander J. L. Gordon, Director of Civil Government Air Operations; F. H. Peters, Surveyor General; J. D. Craig, Director General of Surveys and Boundary Commission, and Captain W. R. Maxwell, Director of Provincial Air Service for Ontario.

Chile

Capt. Marcial Arredondo Lillo, Chilean Army Aviator, and Alfredo Leigh, Chilean Engineer and Aircraft Inventor.

HERE'S THE RIGHT WAY TO GET YOUR START IN AVIATION!

Preliminary Training Important!

"So you want to break into Aviation, eh? Why?"

"Because I feel there is a good future in Aviation. It is rapidly becoming a big industry."

"You bet. Air Travel is revolutionizing transportation. In a short time you will see big freight and passenger liners soaring between New York and San Francisco. There will be plenty of opportunities for serious minded men. But tell me this—have you had any Aviation training?"

"Well, no. I am trying to find a way to get started."

"Listen, Buddy. Let me save you a lot of time and grief. If you want to break into Aviation the right way, get your preliminary training first. Success in any undertaking depends upon the right start, and this is doubly true in Aviation.

"Can you read an air map, an inclinometer, an altimeter? How would you take off? How does the weather affect flying? How are airplanes designed? These and a hundred other things you should know before you can expect anything from Aviation. They haven't got time around a busy airport to give you this basic training.

"Why don't you take a Home Study Course in the basic fundamentals of Aviation? It's just what you need before you go to a flying school. You'll learn the inside facts which are so essential to your success. You'll find this training chockfull of interest—mighty fascinating. Then, when you finish you will find it twice as easy to get ahead. Your chance of getting promotion will be twice as good.

"Hey Bill! What's the name of that Aviation School in Chicago? That's it — American School of Aviation, established in 1916—the oldest school of its kind in the country. Write them for full information."

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Wang Chen Foh, Engineer.

Columbia
Senor George Biedermann.

Costa Rica
Hon. Don Manuel Castro Quesada, Minister to Washington.

Cuba
Capt. Eduardo Laborde, Cuban Army; and Ensign Arnot de Plazaola, Cuban Navy.

Czechoslovakia
Dr. Jan Papanek, Secretary to Legation.

Denmark
Peter Olaf de Treschow, First Secretary of Legation.

Dominican Republic
Hon. Maximo L. Vasques Gautier, Dominican Minister to France, Italy, Switzerland and Belgium.

Great Britain
Rt. Hon. Lord Thomson, formerly Secretary of State for Air; Capt. R. J. Goodman Crouch, Supply and Research Department of the Air Ministry; and Wing Commander T. G. Hetherington, Air Attache, British Embassy.

Greece
Angelo Anninos, Counselor of Greek Legation.

Guatemala
Dr. Don Ramiro Fernandez, Secretary of Legation; and Aviator Commander Oscar Morales Lopez, Guatemalan Army.

Hungary
Hon. Count Laszlo Szechenyi, Minister to Washington.

Irish Free State
William J. B. Macaulay, First Secretary of Legation.

Esthonia
Col. Victor Mutt, Esthonian Consul General in New York.

Finland
Hon. L. Astrom, Minister to Washington.

France
Pierre Etienne Flandin, Vice President of the Chamber of Deputies; M. Franck, Engineer in Chief of Aeronautics in Air Ministry; Gabriel Voisin, Aviation and Automobile Manufacturer; and Major Georges Thenault, Air Attache, French Embassy.

Germany
Privy Counselor Fisch, Assistant Secretary for Air, Reich Ministry of Transportation; and Dr. Emil L. Baer, Secretary of German Embassy.

Italy
Exc. Gen. Italo Balbo, Undersecretary of State for Aviation; Count Alberto Marchetti di Muriaglio, Counselor of Italian Embassy; Col. Tedeschini, Royal Air Force; Major Bitossi, Royal Air Force; Lieut. Cagna, Royal Air Force; and Commander Silvio Scaroni, Air Attache, Italian Embassy.

Japan
Setsuzo Sawada, Counselor of Embassy; Capt. Nobuichi Kusonoki, Assistant Military Attache; and Lieut. Yoshitake Miwa, Imperial Japanese Navy and Assistant Naval Attache.

Mexico
Guillermo Villasona, Chief of Civil Aeronautics Department of Mexican Government.

Nicaragua
Gen. Jose Solorzano Diaz, Consul General in New York.

Norway
Alexis H. G. O. Lundh, Counselor of Legation.

Panama
Hon. Dr. Don Ricardo J. Alfaro, Minister to Washington; Ramon Arias, Sr.; Ramon Arias, Jr., Panaman Aviator; Eduardo Icaza, Civil Engineer; Guillermo Single, Panaman Aviator; William Y. Boyd, American resident.

Persia
Mozaffar Mirza Firouz, Second Secretary of the Legation; Dr. Marcellus D. Redlich, Acting Imperial Persian Consul in Chicago, and Henry G. Finkel.

Poland
Julian Eberhardt, former Vice Minister of Communications, and Wittold Wankowicz, Commercial Counselor.

Serbs, Croats and Slovenes
Bojidar P. Stoianovitch, Secretary of Legation, and Dushan Sekulitch.

Siam
Lieut. Col. Phra Amara Sakdavudh, Member Siamese Air Force; Maj. Luang Devesr Amnuayriddhi, Member of Siamese Air Force, and Luang Chara, Third Secretary of Siamese Legation.

Spain
Maj. Victoriano Casajus, Military Attache; Maj. Joaquim Perez Seoane, Chief of Section of Airports, and Senor Don Juan J. Juaregui y Gil, Chief of Section of Aero Traffic.

Sweden
Nils Gustaf Weidel, Commercial Counselor of Legation and Karl Lignell, Chief Engineer and Traffic Manager Aerotransport.

Switzerland
Etienne Lardy, Counselor of Legation.

Turkey
His Excel. Ahmed Mouhtar Bey, Turkish Ambassador to the United States.

Venezuela
Luis Churion, Secretary of Legation, and Lieut. Miguel Rodriguez, Venezuelan Army Aviator.

The official delegates of the United States of America were Joseph S. Ames, Senator Hiram Bingham, F. Trubee Davison, Lester D. Gardner, W. Irving Glover, Harry Guggenheim, Nelson T. Johnson, Charles A. Lindbergh, William P. MacCracken, Edward P. Warner, William F. Whiting, and Orville Wright, who was the guest of honor at the Conference.

In addition to the official delegates

AIRPLANE Mechanics and Engine Experts Needed!

A Job for Those Who Enroll During January!

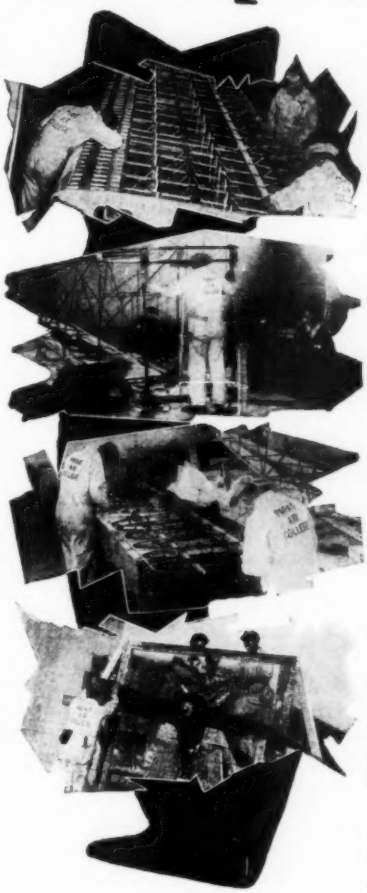
Over 100 airplane factories promise to build 15,000 airplanes in 1929! Thousands of new dealers, distributors, airports, transport and express companies will open. From 75,000 to 200,000 air mechanics will be needed. And there are less than 4,000 licensed airplane mechanics in the whole United States today!

No wonder salaries are high! No wonder experienced, thoroughly trained airplane experts have no difficulty in finding good jobs at high pay and receive fast advancement.

And now Parks Aircraft, Inc., the new $2,000,000 Manufacturing Corporation agrees to give every man who enrolls in the Airplane and Engine Mechanics Course during January a job in the plant, in turn, upon graduation!

There are no strings to this offer except that you reach school in January! The first $175,000 unit of the Parks plant is up—the first ships are in the air! But men are needed—badly—or production cannot go on!

Get into this fascinating profitable industry. Get yourself a position that leads to salaries of $300 to $500 per month—and leads upward to salaries of $6,000 to $25,000 per year as superintendent, production man, factory executive or transport engineer!



Since it costs **no more** to receive Parks training on nearly $200,000 worth of equipment, under skilled instructors—you should investigate this training given by the largest and most elaborately equipped civilian aviation school in the world.

At Parks Air College we have Whirlwinds, Caminez, OX5, Liberty, Hispano-Suiza, Velie and other latest motors. You tear these down, repair them, build them up, and test them.

You learn all about airplanes and engines. You actually build airplanes complete piece by piece.

You learn factory production methods; become qualified for field duty, factory jobs, foreman's and superintendent's positions!

You get field duty on the flying line where you are entrusted with the responsibility of keeping a certain number of airplanes in the air. The Parks job-way system gives you training under actual factory and transport conditions!

PRICES GOING UP!

On February first tuition for the Airplane and Engine Mechanics Course goes up! And only if you enroll during January can we definitely offer you a job, so catch the next train for St. Louis! Seize your opportunity. If you want additional details wire for a free copy of "The Man Who Tunes the Plane," our Mechanics' School catalog, that gives you full particulars of the course, and shows photos of students learning to build and service airplanes and engines. Wire or rush the coupon today!

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Send me "The Man Who Tunes the Plane," and full information of your special January offer.

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from the United States were a number of official representatives.

There were many unofficial delegates from the nations, comprising many figures well known for manufacturing, operating and technical achievements.

Prior to the opening of the Conference most of the delegates were the guests of the City of Chicago and attended the International Aeronautics Exposition in that city.

The delegates were welcomed by an address by President Coolidge.

The Right Honorable Lord Thomson, formerly Secretary of State for Air of Great Britain, and President of the Royal Aero Club, replied to the President's speech of welcome. He pointed out that all the foreign delegates were impressed with the great and rapid progress that had been made in this country in the past two years. He called attention to the fact that distances are great in this country; to the fact that military and defense requirements do not cramp the development of civilian flying by imposing limitations on manufacturers, and finally that in this country there exists a solid financial backing infinitely more substantial than is to be found in any European state.

The various sessions of the Conference reviewed all phases of aviation progress in the matters of general development: civil aviation, air transports, aircraft engines, aeronautical research, aeronautical law, meteorology, aero propaganda, navigation, photography, and airports.

English and French were the official languages of the conference, and sixty-eight papers were presented to the assembled delegates. To avoid the wasting of time, summaries of the papers were read in English and French, and the complete papers were made available by the Government Printing Office to the delegates, so that discussions could follow.

The three morning sessions of the Conference were devoted to Air Transportation; Airway Development, including meteorology and communications; and Trade in Aircraft and Engines.

The evening session on December 13th was given over to the consideration of Pioneering Flights. At this session a motion picture entitled, "Twenty-Five Years of Flight" was shown to the delegates. This film deserves special mention, as it was assembled by taking motion picture records of the American Government, films loaned by the foreign countries, and films of pioneer flights loaned by various news reel companies, and arranging them into a continuity. The films were presented by F. B. Patterson, past president of the National Aeronautic Association. In the audience were many of the pioneer flyers who saw on the screen the record of their own achievements.

Left to right, Capt. R. J. G. Crouch, Lord Thomson, Wm. P. MacCracken, Pierre Flandir.

On December 15th a joint Army-Navy demonstration took place at Bolling Field. The delegates were given an opportunity to inspect the various types of Army and Navy aircraft as well as the many visiting ships.

At the close of the Conference in Washington the delegates journeyed to Kitty Hawk, N. C., arriving there on the seventeenth of December to celebrate the twenty-fifth anniversary of flight by dedicating a memorial to the Wright brothers on the scene of their conquest of the air, December 17, 1903.

Club News

PRELIMINARY plans for the formation of Aviation Country Clubs, Inc., were announced some time ago, and the interest has been so great that already club-units are being established in carefully selected localities all over the United States.

Aviation Country Clubs will combine flying with all the social and outdoor activities of the finest country clubs. Spacious flying fields will be at the disposal of the man who wants to become an expert in aviation, for the youngsters who want to learn to fly and for the ladies as well. Here the finest and most personable instructors obtainable will be on hand with every conceivable convenience available to make flying easy, comfortable and congenial.

The Board of Governors comprises William A. Rockefeller, Charles L. Lawrance, Robert Law, Jr., Sherman M. Fairchild, Earle Osborn, James B. Taylor, Jr., and George B. Post. The first of these clubs, on Long Island, will soon be functioning and within a short time another one in Westchester County, New York. Others will follow as quickly as consistent in Philadelphia, Washington, Newport, Pittsburgh and many other cities.

It is planned to dot the United States with these organizations; a member of one will automatically become a member of all, thus making possible an air tour of the country, stopping each night at one's own club where expert servicing may be had, where one may park one's plane for as long or as short a time as one wants, enjoy meals in the club grill, obtain comfortable sleeping quarters, play a bit of tennis, perhaps do some dancing and then, when so inclined, hop off and fly to the next club enroute.

For those who are not, as yet, actual flyers, there will be the opportunity to absorb the jargon of the flying field, become followers of the sport through close association with those who know the game and enjoy the sight of frequent aerial maneuvers from the spacious observation decks of the club houses.

Among those who have become members of Aviation Country Clubs and are active in their formation are: Miss Ruth Nichols, Miss Amelia Earhart, Harry P. Davison, William B. Leeds, Darwin J. Adams, John S. Reaves, Charles T. Ludington, Cornelius Vanderbilt Whitney, William P. MacCracken, Roland Palmedo, Charles S. Payson, Sebastian L. Pond, John T. Pratt, Edward V. Sperry, George M. Pynchon, Jr., Commander Richard Byrd, Major James Fitzmaurice, Miss Estelle Manville, Sir Hubert Wilkins and Governor Trumbull of Connecticut.

The sponsors of Aviation Country Clubs have borrowed the basic idea from England, Australia and Canada where flying clubs have been in existence for some time past. While the fundamental idea is the same, the general character and purposes of the American clubs are somewhat different; those in the United States are being organized on a much more impressive scale, combining many more activities and more luxuries than those in other countries.

Lady Heath, of London, now in this country, has been a prime mover in developing light aircraft clubs in England and is one of society's ablest pilots. She will, it is hoped, lend a hand in the development of the American clubs.

American society's flying country club idea is based on the enjoyment of aviation in a congenial, attractive and comfortable atmosphere. An interesting feature of the club's plan is the proposed standard design for club houses. The style of architecture is of modernistic type, the buildings to be constructed in the shape of airplanes, making a distinctive landmark for ships aflight. A large lounge, dining room, locker room and servants' quarters will occupy the ground floor; while on the second will be sleeping rooms for members, a grill, smoking rooms, another large lounge for ladies and the observation decks and windows. In addition to the flying fields there will be tennis courts.

The parent organization of Aviation Country Clubs is located in New York City at 551 Fifth Avenue.

Philip R. Grush, 284 Cabot Street, President of the Beverly Aero Club, Beverly, Mass., writes that the club has organized a night course in the theory of flight, aerodynamics and navigation. They have Liberty and Hisso motors on which to work and are actively securing money to purchase a plane early in the spring. A financial plan of stock units for membership in the club is being worked out.

J. L. Smith, 830 "L" Street, Sacramento, Calif., writes of the formation of the Sacramento Aero Club with thirty members in the original group. The club plans to purchase a ship by having the members pay $100.00 down and $150.00 in six payments of $25.00 per month. This movement has caught on very quickly and it is quite possible that within a short time other units will be formed in Sacramento under the same leadership.

The Portsmouth Aero Club of Portsmouth, New Hampshire, is rapidly progressing. At the first meeting held recently fourteen charter members were signed up. Ralph C. Margeson, 1381 S Street, states that regular meetings are now being held and the club hopes to have its own plane flying from the Portsmouth Airport which is now rapidly being cleared.

Good progress is being made with the City of Lakes Aero Club of Minneapolis, Minn. John C. Wells, Vice-president of the club, writes that members are working on the building of a three place training job, designed by Orville H. Hickman, Designer of the Swallow, Pheasant, Air King and Starling airplanes. A 180 H. P. Hisso Motor and a Clark Y wing section will be used. The City of Lakes Aero Club has over seventy new members and now hold meetings at the Central Y.M.C.A. Bldg., Minneapolis, Minn.

A letter from Don Redding, President of the Aero Club of Maryland, reports activity in Baltimore. In addition to furnishing flying instruction at the City Line Airport, the club is organizing a ground school course, and it is expected that ultimately a complete aeronautical school will be sponsored by the club. The cost of instruction has been reduced to a very nominal sum, in order to give young men of moderate incomes an opportunity to learn flying.

What is said to be the first Aero Club organized by any "Prep" school in the state of Virginia has been instituted by some fifteen cadets of the Hargrave Military Academy, Chatham, Va. The club has already subscribed to several leading aviation publications and purchased a ground course for the use of its members.

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KINNEAR ROLLING DOORS

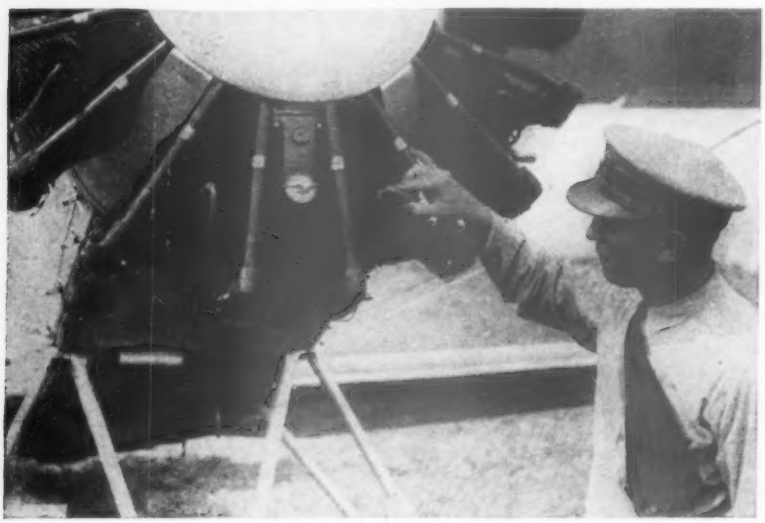
Radio in Aircraft

By S. R. Winters

INTERFERENCE with radio reception on aircraft caused by the engine ignition system has heretofore defied banishment proceedings. Suppression measures have minimized the disturbing noise but attempts at complete elimination have failed. This is true despite well-meaning claims, at intervals, that the problem of ignition interference had been solved. Like the claims in behalf of so-called static eliminators, the stories of ignition-noise "eliminators" have been accepted with a grain of salt. Now, however, a similar claim by the Bureau of Aeronautics, United States Navy Department, is entitled to a full measure of recognition since the problem appears to have been attacked at its source.

Cooperating with a commercial organization, the Bureau of Aeronautics has developed a shielded spark plug which, together with the usual engine-ignition shielding will, it is claimed, completely suppress the noise so long a disturbing factor in radio-telephone reception on aircraft. This shielded spark plug has been subjected to tests on an UO type of observation plane and its gratifying performance as a silencer of airplane engine noises is such that similar installations are contemplated on a pursuit plane and a torpedo plane. In fact, the experiments with this method of shielding conducted by Navy engineers from the Naval Research Laboratory, Bellevue, D. C., at the Anacostia Naval Air Station, have afforded such satisfactory results as to foreshadow quantity production of these shielded plugs at an early date; the Navy Department, on the basis of these tests, encouraging and even inviting their commercial manufacture and installation on various types of planes. This invention, it is said, will double the distance range of aircraft radio receivers.

Lieutenant-Commander A. I. Price, officer in charge of aircraft radio for the Bureau of Aeronautics, in an exclusive interview with this writer, traced the various attempts to solve the ignition-interference problem, noted the obstacles that have retarded the progress of the difficult undertaking, and pointed out why he believed the newly-designed spark plug offers a satisfactory solution. The gravity of the problem and the importance of its correct solution are suggested when we are reminded of the increasing use of radio telephones on aircraft for the reception of weather forecasts and other information pertinent to the safety of aviators. The Airways Division of the United States Department of Commerce, for instance, is to establish marker radio beacons along the civilian airways for the furnishing of radio-telephone communications to airplanes in flight, and the receipt of these messages necessitates the elimination of aircraft engine disturbances that would interfere with audible reception. The Bureau of Standards has indicated the absolute necessity for some form of airplane-engine shielding in order to effectively use radio beacon services.



Lieut. G. H. De Baun, U. S. N., exhibiting the new spark plug for air-craft engines which eliminates ignition static.

"Everyone identified with radio," points out Lieutenant-Commander Price, "has been endeavoring to solve the ignition problem for a number of years. The Departments of Navy, War, and Commerce have been trying to eliminate ignition disturbances, which produce a very high noise level in all aircraft radio receivers. The problem, however, was never as serious an objection to the Navy, up to the present time, as it has been to other Government services employing radio-telephone instead of radio-telegraph communication. This is due primarily to the fact that a greater distance is obtainable from radio telegraph than telephone apparatus, with the same power input. The Navy's program of developing suitable light-weight radio-telephone equipment for small planes introduced to the service the necessity of ignition shielding.

"For more than two years, the Navy has experimented with various methods of inserting high-frequency chokes in the ignition system of aircraft but these proved unsatisfactory for various reasons. At first, the Navy did not look with favor upon the shielding of ignition leads, since in the older systems of ignition the insulation on these leads was regarded as insufficient to prevent ignition current from penetrating the insulation and grounding on the surrounding shielding. With the advent, however, of superior ignition cable and with the Navy's development of the Scintilla magneto it was found possible to shield the ignition system without causing a breakdown of the insulation.

"In the past, various methods have been employed by other services in shielding the ignition system, but these attempts usually stopped at the spark plug—although some spark plug caps were developed for enclosing the plug. The primary objections to these caps were their bulkiness and difficulty of installation on certain engines, where the available space for the spark plug is restricted. And, in addition, they do not radiate sufficiently the heat which is encountered on high-compression engines.

"It is believed that with the shielding system previously employed and with the shielded spark plug recently developed, the problem of suppressing the noise of engine ignition has been solved. Some additional experiments will probably be necessary on the test installation, but the Navy believes that it will shortly be ready to procure production installations for its planes which will carry all types of radio equipment."

Our Library and Yours

A BOOK on flying as an art and profession, and a book about early flyers in China, India, and mediaeval Europe are of interest this month. Captain Macmillan and Dr. Berthold Laufer are both well-known in their fields, and these books are of special interest because of the authority with which they are written.

THE ART OF FLYING, by Capt. Norman Macmillan, M. C., A. F. C. Pub. by Edwin Valentine Mitchell, Hartford, Connecticut, 1928. 175 pp. Illus. Price, $1.75.

Books describing the management of airplanes in flight are not uncommon. The interest in flying is so great at the present time that training manuals are read very eagerly, and it may be, more or less indiscriminately. Among the various available treatments of the topic, however, a certain few are notable for the originality, or the clarity, or the vigor with which they present the standard set of facts relating to all airplanes and all pilot's cockpits. Captain Macmillan's book is among this limited group. It is quite definitely an addition to the existing fund of material on the art of piloting an airplane.

Captain Macmillan has been steadily engaged in flying ever since war days. He was a Lieutenant and Flight Commander in the Royal Flying Corps, with an official record of having accounted for ten enemy planes. He was decorated with the Military Cross and the Air Force Cross. Since the war Capt. Macmillan has participated in a number of important flights, including two attempts to fly around the world. For the past few years he has been a test pilot.

Possibly the point of view naturally taken by one concerned with the development and practical application of new theories accounts for the unusual thoughtfulness of this book. It may be said, though the statement is likely to be misunderstood, that Capt. Macmillan deals with the philosophy of flying. This quality makes the book of value to almost anyone anxious to get a clear and ordered idea of the aerodynamic facts which make flight possible.

The Art of Flying covers the field of elementary airplane piloting. Little is said about aerobatics or stunt flying. As a mere book of rules for pilots the book is inclined to be sketchy. But space denied matters of technique is given to principles which lie behind the technique, and the result as judged by its actual value certainly justifies itself.

The operation of seaplanes, the complete speed range, the art of test flying, and types of aircraft and why, are all topics covered with marked originality and freshness. Captain Macmillan has done a very intelligent and helpful piece of work in writing The Art of Flying.

THE PREHISTORY OF AVIATION, by Berthold Laufer. Pub. by the Field Museum, Chicago, 1928. 93 pp., 12 plates photogravure. Price, $1.25.

One of the most curious publications which has yet been issued in the field of aeronautics is The Prehistory of Aviation, by Dr. Berthold Laufer, Curator of Anthropology, and Sinologist of the Field Museum of Natural History, Chicago. In this monograph Dr. Laufer gathers and discusses a quantity of material from Far and Middle Eastern sources relating to aviation, real or fancied. Certain mediaeval European attempts at flight are also noted briefly. Dr. Laufer does not seem to have an ax to grind in spite of his conviction that Chinese investigators preceded all others in the study of

(Continued on page 104)

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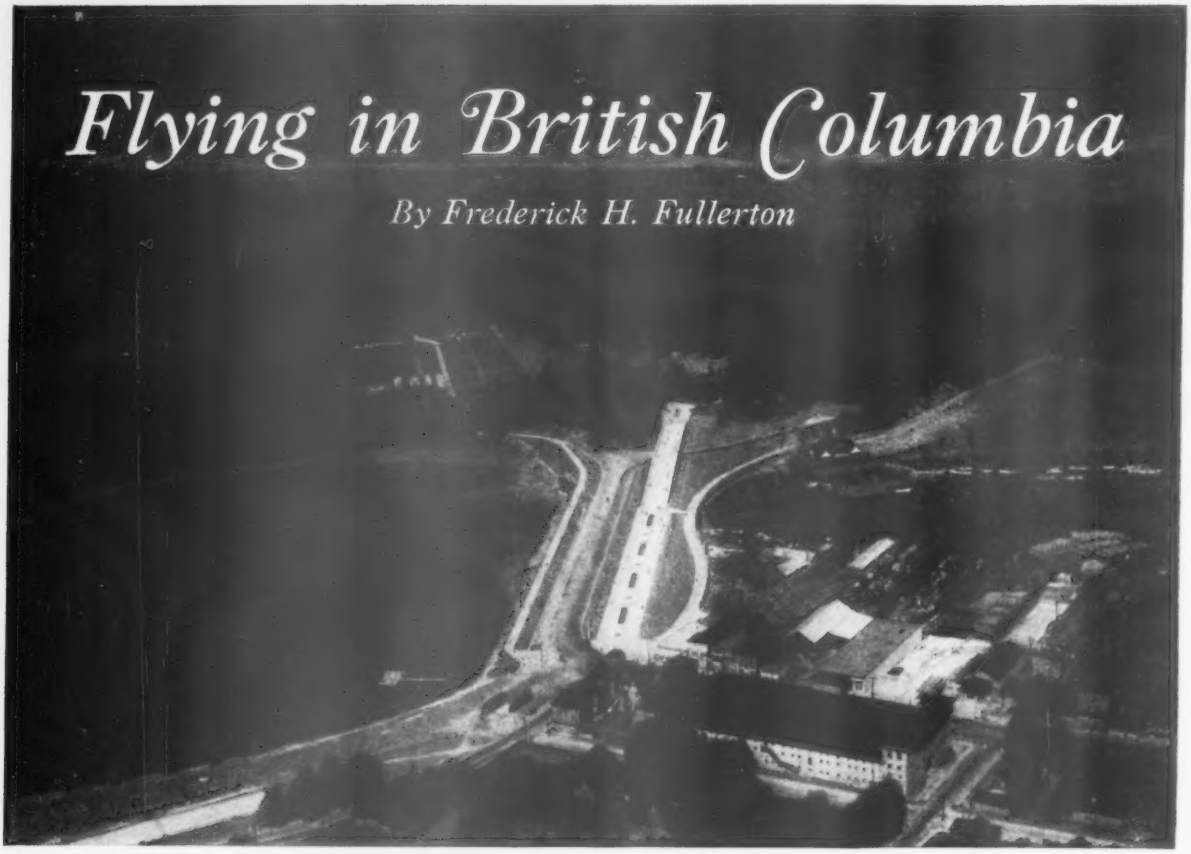
Flying in British Columbia

By Frederick H. Fullerton



A corner of the park and harbor at Vancouver, B. C.

COMMERCIAL aviation in British Columbia has made very rapid strides during the past 12 months. The use of airplanes and seaplanes, not only for providing a medium of fast transportation, but also for operation in fishery and forestry patrol work, photographic work, and many other different activities has developed at a phenomenal speed around the cities of Vancouver and Victoria. Vancouver, by reason of the fact that it is the commercial capital of the province of British Columbia, is possibly the largest centre of aviation in the Western Canadian provinces, and this city is today the headquarters of two flying schools and also of several private airplane companies, as well as a station for the Royal Canadian Air Force.

Development of aviation in Vancouver can be traced to the work of what is now the Vancouver branch of the Aero Club of B. C. Squadron Leader A. Earl Godfrey, who recently completed the flight across Canada, played a very important part in setting commercial aviation in British Columbia on a sound basis, when he fostered the organization of what is now the Aero Club.

In 1923 Squadron Leader Godfrey became acquainted with the fact that there were a number of organizations which were to some extent interested in aviation in the city of Vancouver. These organizations had no aggressive program, however, and were largely in the nature of social rendezvous for ex-officers of the flying branches of the Allied armies. Squadron Leader Godfrey invited all men in Vancouver interested in aviation to attend a meeting at the air station and at this meeting the International Air Force Club was formed. The International Air Force Club was shortly afterwards given the title of the Air Force Club of B. C., and the first president of the organization was Major A. D. Bell-Irving, M. C. During the next two years this club developed at a rapid rate and in the year 1925 they forwarded a resolution to the Canadian Senate and House of Commons in which they requested action on the part of the government towards the encouraging of the establishment of air force clubs throughout all of Canada. The plan outlined for the establishment of these clubs contemplated that the government should authorize the Royal Canadian Air Force to place its equipment at the disposal of bona fide members of air force clubs, and that flying instruction would thus be available under the supervision of qualified officers attached to the government force.

In 1926 negotiations were started by the Air Force Club of British Columbia with the Air Force Club of Manitoba in an attempt to institute the joint organization which would embrace air force clubs throughout the whole of Canada. To further increase interest in aviation, a series of talks was given over the radio by Captain Leonard Miller, secretary of the Air Force Club and also secretary of the various organizations of a similar nature which had branched out, and by Major D. R. McLaren. Finis was written to the activities of the Air Force Club of B. C. in December, 1927, when in order to qualify for recognition under the Canadian government scheme for the supply of light airplanes to flying clubs, the club officially dropped the word "force" from its name and became recognized as the Vancouver branch of the Aero Club of B. C. A similar organization was also established at Victoria, and was known as the Victoria Aero Club. In Victoria the landing field and hangars of the B. C. Airways Limited were available and the club secured permission to use these and secured an official license for these landing fields from the Dominion authorities.

A very different situation prevailed in Vancouver, however, where the city council showed a certain amount of indifference regarding the encouragement of civic aviation. After considerable force had been brought to bear on the council and the extending of an invitation to Col. Lindbergh to visit the city and the refusal to comply with this request by the famous flying ace on account of the lack of a proper landing field at Vancouver, Mayor L. D. Taylor became particularly interested in encouraging aviation.

In May, 1928, the city council approved of the leasing of 50 acres of land on Lulu Island to form a temporary air port, and also agreed to expend $7,500 in preparing this field for aviation use. Matters were, however, allowed to lie over until in the middle of July two requests for the use of the civic airport were received from companies wishing to start an immediate daily service between Vancouver, Victoria and Seattle. These companies were the Commercial Air Transportation Company of Everett, Washington, and the B. C. Airways Limited of Victoria. Realizing the necessity for prompt work the Vancouver council wired Ottawa for confirmation of the license which had previously been applied for and immediately on receipt of this a temporary landing field was rented and the hay on the field ordered cut. This order was made on July 22 and two days later the first airplane landed at Vancouver's new airport and came to rest amid a field studded with hay cocks.

The honour of being the first plane to reach Vancouver went to the Ryan four-passenger monoplane of the Commercial Air Transport Company, which was piloted by John Langdon who was accompanied by John Scott of Everett, Wash., manager of the company.

A few minutes after the Ryan, the second plane arrived at the field. This was the Ford-Stout tri-motored monoplane of the B. C. Airways Limited, Victoria, which was piloted by Harold Walker, with T. H. Cressy as his mechanic. Passengers on board this plane included Mayor L. D. Taylor of Vancouver, Mayor Carl Pendray and Mrs. Pendray of Victoria, G. E. Eve, president of the B. C. Airways Limited, G. A. Cameron, secretary of that company, G. H. Beatty, M. L. A., Victoria, and a number of other prominent citizens of both Vancouver and Victoria. An unfortunate incident which marred the opening of the air field occurred when Mayor L. D. Taylor, after alighting from the plane, moved forward to address one of the welcome committee, and was struck on the head by the propeller of the airplane. After a considerable period spent in the hospital he eventually recuperated and was able to resume his civic duties.

Following the establishment of this service a regular schedule of two trips daily to Victoria and Seattle was arranged by the B. C. Airways Limited, while the Ryan monoplane of the Commercial Air Transport Company, which was equipped with the Wright engine, was operated on a daily round trip between Vancouver and Seattle, with a stop at Everett, Washington, en route.

For a considerable period prior to the establishment of the regular daily service both the Dominion Airways and Pacific Airways had been carrying on operations in Vancouver. These firms, all using seaplanes, used the waters of English Bay as their landing place, and made their headquarters adjoining the headquarters of the Royal Canadian Air Force at their Jericho Beach station.

About the time that regular service was commenced from Vancouver the Pacific Airways was taken over by the Western Canada Airways Limited, of Winnipeg, and Major D. R. McLaren, D. S. O., who had distinguished himself during the war and who had been head of the Pacific Airways, was retained as B. C. manager for Western Canada Airways Limited. Utilizing Boeing flying boats, equipped with Pratt and Whitney wasp engines, this company operated a daily service between Vancouver and Victoria. These flying boats all were equipped with floats.

Captain E. C. W. Dobbin, head of the Dominion Airways Limited of Vancouver, was at this time and still is operating his boats on a government contract for forest fire patrol work. De

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The waters of English Bay, Vancouver, B. C., shelter seaplanes operating in the western coast province.

Havilland Moth seaplanes are used exclusively by this firm. The Western Canada Airways, when it took over the Pacific Airways secured three flying boats these being an old HS-2L with a Liberty engine, a Vickers Vedette and a Boeing machine. These three flying boats were operated in fisheries patrol service for the Dominion government.

Having got away to a good start, commercial aviation was seriously interrupted by the loss of the Ford monoplane of the B. C. Airways with five passengers and two pilots on board. This machine left Victoria at four o'clock one Saturday afternoon and was never seen again. Both United States and Canadian planes and United States custom patrol boats and Canadian destroyers united in the search for the plane, but without success. Part of the wreckage and the bodies of some of the passengers have since been washed ashore.

Following the loss of the ill-fated G-CATX, commercial aviation in British Columbia was for a while almost paralyzed.

Since then the regular service of the Commercial Air Transport Company is receiving a good volume of business again, while the B. C. Airways of Victoria are practically ready, according to their announcement, to recommence service. The recommencing of this service was delayed for some time pending the publishing of the finding of the inquiry held under government auspices concerning the wreck of the Ford monoplane. Considerable controversy also took place regarding the advisability of using such a machine as the Ford monoplane on a route which lay largely over water, and the advantages of a seaplane for this route were stressed by many. The B. C. Airways Limited, have, however, practically decided to use the same type of plane when they are ready to resume service.

Ernest Eve, president of the company, states that the Canadian department of national defense has approved of the replacing of the airplane lost by one of a similar make, while Henry Ford has advised the company that his firm has perfected a system of flotation which will indefinitely keep the machine above water.

An extract from the finding of the court of inquiry into the disaster stated, "It is not proposed to forbid at present the use of tri-motored land planes on the Victoria, Seattle, Vancouver route. Provision, however, should be made for flotation gear and for some emergency means of exit in the case of the airplanes becoming submerged."

Just about this time also officials of the aviation branch of the department of national defense threatened to cancel the license of the Vancouver civic airport owing to the improvements which were to have been carried out at the temporary airport not having been completed. When this intimation was made to the city council work on the grading of the field and erection of hangars, proper classification markers and a wind cone were pushed ahead with greater speed, and while all the work is not completed the field is now in such a state that it can be used by a certain number of planes, and is particularly well equipped for commercial aviation. An additional grant was also made by the civic finance committee for work on this field so that in all, over $14,000 was devoted to the development of the temporary airport by civic authorities.

Establishment of a permanent airport at a site convenient to the city is also receiving consideration at the present time, and officials from the aviation branch of the department of national defense at Ottawa recently visited Vancou-

Squadron Leader Earl Godfrey delivering the first bag of mail to cross the continent by an all-Canadian route to Postmaster Clarke at Vancouver.

ver for the purpose of presenting a report as to which of a number of sites suggested was the most suitable for the nature of development which it was proposed to carry out.

Meanwhile, during the time that the B. C. Airways Limited were considering resuming their service, H. B. Olsne, president of the Empress Taxi Cab Company and Grey Line Stages, of Victoria, B. C., announced that if the B. C. Airways did not resume their triangular service he would establish such an air line. Mr. Olsne left for a trip to the East for the purpose of securing information regarding the establishment of this new air service and for particulars of machines which would be most suitable for operation on this route, immediately following this announcement, and nothing definite is known as to whether he still intends to commence a new air service in the face of the very probable competition from the B. C. Airways, Limited.

The establishment of a Vancouver branch by the Western Canada Airways Limited is also believed in Vancouver flying circles to augur well for future development, as this firm has at present extensive interconnections between the prairie provinces, and it is believed that an attempt will be made to join up the firm's base at Winnipeg in the Canadian middle west with the Vancouver organization, and by this means establish an all-Canadian transcontinental air service.

A remarkable event which will undoubtedly have considerable effect on the progress of flying in Western Canada was the spanning of the Dominion in the first transcontinental flight by an all-Canadian route recently by Major A. E. Godfrey. Squadron Leader Godfrey, accompanied by Wing Commander L. F. Bredner and Wing Commander Lindsay Gordon of Ottawa, and Sergeant Major M. Graham, mechanic, arrived in Vancouver on September 8 after making his way across the continent with but two stops. Forest fires with their heavy clouds of smoke combined with heavy fog in making the flight more dangerous than was anticipated and at times the party had considerable difficulty in finding out just where they were. But nevertheless, despite all difficulties, the gigantic yellow-colored Fairchild seaplane pioneered the way across the Dominion and delivered the first Canadian air mail to go by a direct trans-Canada route.

On arrival near Vancouver, B. C., the plane was met by Flight Lieut. Hull, Commander of the Jericho Beach station of the Royal Canadian Air Force at Vancouver, and escorted to a safe landing place in English Bay opposite the airport. The seaplane and its crew were received without much formality, the daring flight being simply considered as part of the day's work and thus Major Godfrey landed at the shores of the airport of which he was in command for several years.

Immediately following his arrival he handed over his bag of trans-Canada mail to Postmaster G. A. Clark of Vancouver, and then, this official duty accomplished, he turned to greet his father and mother, who both reside in Vancouver.

On the return trip the party flew north to Prince Rupert, B. C. Much excitement reigned in British Columbia on the day the plane left Vancouver, when it was reported to be off its course and over little inhabited and rocky territory. Later the plane was reported as failing to arrive at Prince Rupert and it did not reach the northern port until a day and a half later. It was then found that the plane had been forced to descend in heavy fog, and that the flyers had spent the night with two loggers in their lonely camp in northern British Columbia.

When the plane left Prince Rupert it proceeded through the Peace River country and it was here that disaster overtook what had otherwise been an epoch-making and most successful flight. The plane came down in the Peace River district and its crew were completely lost to the civilized world for a number of days, but were later discovered by one of the rescue parties and brought back to civilization.

Aerial photography and photo-topographical survey operations have also become more and more popular in British Columbia. Flying Officer A. I. Morfee of the Royal Canadian Air Force has just returned to Jericho Beach air station and was followed a short time later by Flying Officer E. J. A. Burke. These two officers with their crews conducted an aerial photo topographical survey over the Shuswap section of the national map

(Continued on page 104)

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Model Builders' Department

Conducted by Bertram Pond

TELL all of your model builder friends that Aeronautics (the fine new name for Popular Aviation—glad you like it!) has arranged for the Model Section to be even better than our readers have told us it was in the past!

Everyone will want to get in on these special articles giving the construction of feather-weight compressed air motors and models, big 75″ trimotor machines, scale models of famous planes, and world record models (models holding at least three of the world's records are scheduled). Along with these feature articles on models every month, Aeronautics will have a host of news items and some discussion on model theory.

You should renew your subscription today so that you will not miss a single one of the issues, and remember that Aeronautics excels in other departments, as it does in its Model Section. Each department gives its true aviation story, as does the Model Department, which has always endeavored to give credit where it belonged.

Illinois Club Banquet

The oldest model airplane club in the country staged a most successful model airplane banquet on Tuesday evening, November 27th, at the Auditorium Hotel in Chicago in the brilliant Crystal Room.

Many dignitaries were assembled from afar, along with the regular club members, and they celebrated not only another successful year, but a year marked with many striking achievements.

Among these was the little matter of breaking several world's records and winning numerous contests. The world's indoor record was broken by members of this club at the Chicago Tribune's contests numerous times, in which the members played tag with each other in breaking the record. They were forced to fly in a low ceilinged room and after holding this record for some little time they had to relinquish it at the Detroit contest, as the Illinois model flyers were not prepared for a very high ceilinged room, and consequently did not have high climbing indoor models.

The famous Mulvihill trophy pictured with this article was returned to the Illinois Model Aero Club. This is about the most valuable annual model trophy competed for anywhere. It was won by the Illinois Model Aero Club members in 1923 by Mr. Edward Lange at St. Louis; in 1924, at Dayton, Ohio, by Mr. Robert Jaros; in 1925, at New York, by Mr. Bertram Pond, and in 1926, by Jack Loughner of Detroit, who used a model patterned after Messrs. Jaros' and Lange's machines. Plans of these models were distributed by the Illinois Model Aero Club in hopes of creating a little competition, and since the broadcasting of these plans the competition has been made worth while. However, the Illinois Model Aero Club had little difficulty in regaining the coveted trophy at Detroit in 1928, when Mr. Joseph Lucas lost his model, with an official time of 264 seconds, when it disappeared from sight of the judges, who, unfortunately, had not been provided with a means of following the flight; for the model flew for about 11 minutes, according to the several stop watches owned by prominent model flyers who followed it towards Mt. Clemens, Michigan, where they were forced to watch it disappear in the distance from the bank of the river.

Of course, Mr. Lucas was much feted at this banquet for his great flight. However, it can be truthfully said that no one at the model meet deserved the distinction more than Mr. Lucas, for he had the best constructed machine of all the hundreds of competitors.

Not to be outdone by Mr. Lucas, at the Atlantic City contest of the Playground and Recreation Association, Mr. Donald Lockwood broke the world's indoor glider record, and Mr. Myers won the outdoor commercial model contest. In the series of contests conducted by the model club itself, Mr. Carlson broke the outdoor R.O.G. duration record for twin pushers.

The tasteful menu of model bombs, dope, streamline struts, wheels, and other delicacies was enjoyed by the distinguished gathering, which included besides the above mentioned model flyers the famous plane manufacturer, E. M. Laird; England's Lindy of the early days of flying, Mr. Walter Brock; Mr. Charles Dickinson, the former air mail contractor, and others. A number of original stunts were presented by members of the club as entertainment.

Mr. Jaros gave a most straight-forward talk on the sportsmanship of model builders, which gave the new model flyers an urge to retain the many honors now held by the club, and left the old timers wishing that they could once again wind up their delicate models and adjust them with that tingling, sensitive touch, and once again send their models into the air carrying the I.M.A.C. monogram on wings of victory.

Thus, the club which has originated many of the model ideas and plans known today the world over, celebrated a very successful year and pledged itself to do even better for the year 1929, carrying on the traditions of the Illinois Model Aero Club as honorably as they have always been borne.

Illinois Club Exhibits

The Illinois club was out in front once more at the Chicago show with an exhibit of their accomplishments.

This exhibit included a Lucas prize winning model, of the type of the winner of the Detroit outdoor duration contest, the record Commercial model of Mick Myers, sundry wings and parts of the record speed duration racers, models, and gliders. The club also had a model of the Pitcairn Mail Wing, an S. E. 5 Scout and a Stinson, besides a show case which contained finished propellers, floats and model parts placed around the many trophies and cups which this organization and its members have won from time to time.

A very interesting model was the Atom. The Atom must be seen to be appreciated. It is a very accurate little two inch wing span, hydro tractor model which is capable of performing antics in the air.

The Illinois Model Aero Club has always had a booth at prominent air shows and expositions in Chicago and this booth was a credit to the members of this aggressive model airplane society.

World Record Model

Thousands of visitors at the Aero show were given a thrill by being able to see the original World Record hydro model at the Popular Aviation booth. This large grass-hopper or Jersey mosquito, or whatever you want to call it, which hailed from Peru, Indiana, was hung up where everybody could see it. It carried a simple but effective sign, stating that it held the official world's record of twelve minutes and thirty seconds, for a hydro flight.

At the other side of the booth hung a beautiful folding wing Fairchild model which attracted the attention of everybody, including the many prominent visitors at the show. This model was hung so that the light could shine through the wings and show the beautiful built-up work on the ribs, flaps and ailerons.

Models at International Show

The Model Editor took a prolonged stroll around the various booths at the recent International Air Show in Chicago and he was surprised at the great number of model planes on exhibit in the various

(Continued on page 102)

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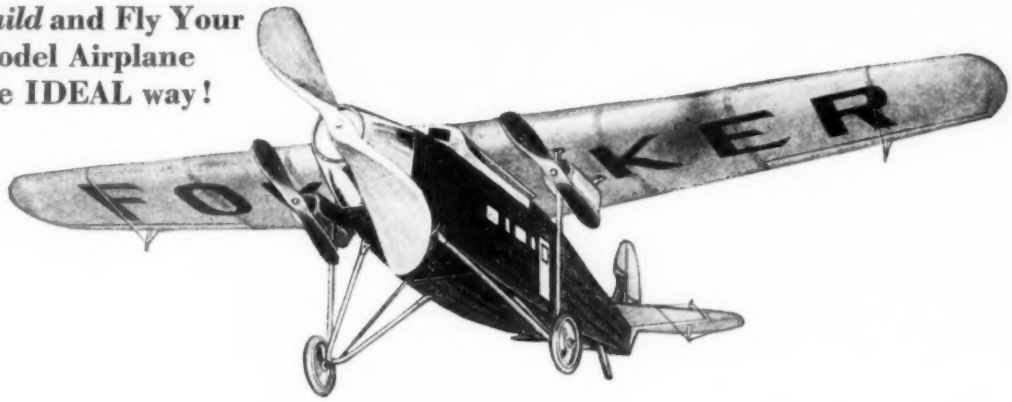

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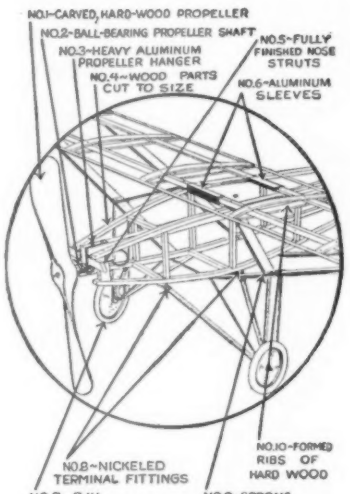

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Simple Aerodynamics

By Alexander Klemin
Daniel Guggenheim School of Aeronautics, New York University.

Flow Around a Wing, Experimental Methods, A Typical Wing

Why a Cambered Surface is Better than a Flat Plate

ALMOST any surface inclined to the wind will provide lift, and a flat plate will provide lift. But besides securing lift from a wing, we need high efficiency, that is, a high ratio of lift to drag, and this is largely a question of smooth flow. In Fig. 1, we show

Fig. 1. Flow of air around a flat plate.

diagrammatically the flow of air round a flat plate inclined at a small angle. In spite of the small inclination the flow is disturbed and there are eddies or whirls on the upper surface of the plate. For the cambered wing of Fig. 2, the flow is perfectly smooth, though the wing is

Fig. 2. Flow of air around a cambered surface inclined at 2 degrees.

inclined at 2 degrees. This is a visual and convincing proof of the superiority of the cambered wing.

Flow Around a Wing Changes with Inclination

In Fig. 3 the same wing is shown at an inclination of 10 degrees. The flow

Fig. 3. Flow around a wing inclined at 10 degrees.

begins to be fairly turbulent. At 18 degrees inclination as shown in Fig. 4, the flow is very rough indeed, and the air does not follow the upper contour of the wing at all.

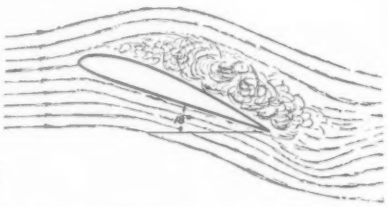


Fig. 4. Flow around a wing inclined at 18 degrees.

From these diagrams of the flow (which are based on actual photographic studies), the following conclusions can be drawn:

At small angles, the flow is smooth, the air deviates but little. The drag as well as the lift will be small.

As the angle of inclination increases, so will the deviation of the air. The lift will increase, but so will the drag.

Finally, at a sufficiently large angle, the lift will reach a maximum value. Since the flow is now thoroughly disturbed, any further increase in inclination will actually cause a decrease in lift and an increase in drag. This point of maximum lift is termed the "burbling" or "stalling" angle, and stalling bears a great importance to safety in flying.

There is quite a technique in the visual or photographic study of flow. Sometimes water is made to flow past a surface, with coloring matter, or skim milk, or aluminum powder introduced into the stream, so that the actual flow can be photographed. When air is the medium investigated, a jet of acetylene may be carefully introduced into the general flow system. The acetylene has optical properties differing from those of the surrounding air, and hence can be photographed. Again an electric heating coil can be introduced into the air stream and the heated air photographed. Nothing is so instructive as such visual or photographic study. "Seeing" the flow is not sufficient however; we have to measure the forces involved.

Measuring Forces in the Wind Tunnel

The wind tunnel is based fundamentally on the principle of relative motion which states, as we have already seen, that a stationary object with air moving by at a certain speed will have identical forces acting on it as an object moving through the air at that speed. It would be very inconvenient, almost impossible to measure forces on gliding models. It is much easier to hold the model at rest and force the air to flow past it, and this is actually done in the wind tunnel, which is used to determine the aerodynamic characteristics (such as lift, drag and center of pressure) of flat

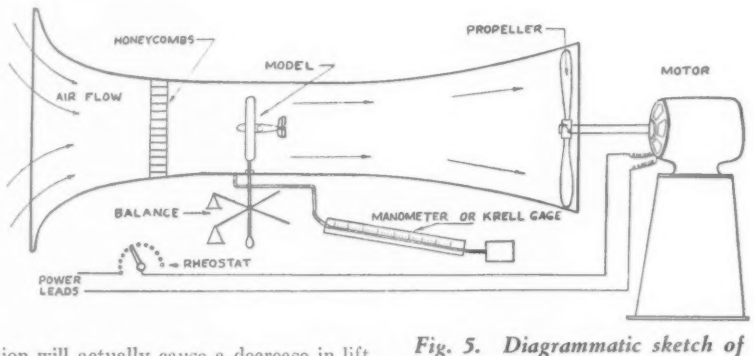


Fig. 5. Diagrammatic sketch of a wind tunnel.

plates, air-foil sections, and complete airplane models.

A diagrammatic sketch of a wind tunnel is shown in Fig. 5. The propeller at the right end is rotated by means of an electric motor and kept at any desired speed.

This propeller draws the air from the tunnel and thrusts it out into the room. The air at the other end of the tunnel then rushes in through the entrance cone. This cone is very large at the open end and tapers down gradually in a smooth curve as it approaches the working section. A smooth curve is necessary to prevent the air from becoming turbulent as the area of the section is decreased. The working section has a small area so that we can obtain a high wind velocity without using too powerful a propeller. Between the entrance cone and the working section is a honeycomb which looks like an automobile radiator from the front. This together with the curved wall keeps the air flow smooth and straight. From the working section out, the tunnel gradually enlarges in diameter up to the propeller, as a large propeller, slowly rotating, is found most efficient for wind tunnel work.

The velocity of the wind in the tunnel is measured by means of a Krell gage. This is merely a long inclined tube whose lower end is connected to a reservoir of alcohol. The upper end of the tube is connected to the wall of the tunnel. As the wind passes by, it sucks some of the air out of the tube and the liquid in the reservoir rises in the other end of the tube. The greater the speed of the wind in the tunnel the more the suction and the higher the rise of the liquid. A graduated glass tube is used so that the exact height of the liquid may be observed at any particular wind speed. By the aid of Bernouilli's law, the velocity can be readily calculated.

The model is set up in the working section. It is supported on a spindle attached to a balance or weighing machine as shown in Fig. 6. The model is generally supported in the tunnel as though it were flying on its side. The air forces acting on the model are not affected and may be measured more readily with this arrangement. The lift and drag forces are measured by two arms on the balance placed at right angles to each other. A circular disk is graduated in degrees and the spindle may be rotated to obtain any desired angle of attack on the model. Readings are usually made of lift and drag for every two degrees within the working angles of the airplane. Curves are then plotted which give the characteristics throughout the entire range.

The measured forces on the small model may be suitably scaled-up to give the forces on a full-sized plane. We have found that the lift and drag are proportional to density, area and velocity squared. The area of the model is known from its dimensions and the velocity of the air in the tunnel is determined by the gage as previously explained. Suppose we have an airfoil section of ½ sq. ft. area being tested at 40 m.p.h. in the tunnel. Suppose the lift force reading to be 1 lb. and the drag 1/12 lb. Let us find the lift and drag on such an airfoil which at full size has an area of 300 sq. ft. and flies at 80 m.p.h.

$$\frac{\text{Lift full scale}}{\text{Lift of model}} = \frac{(\text{Area} \times \text{Velocity}^2) \text{ full scale}}{(\text{Area} \times \text{Velocity}^2) \text{ of model}} = \frac{300 \times 80^2}{\frac{1}{2} \times 40^2} = 2400.$$

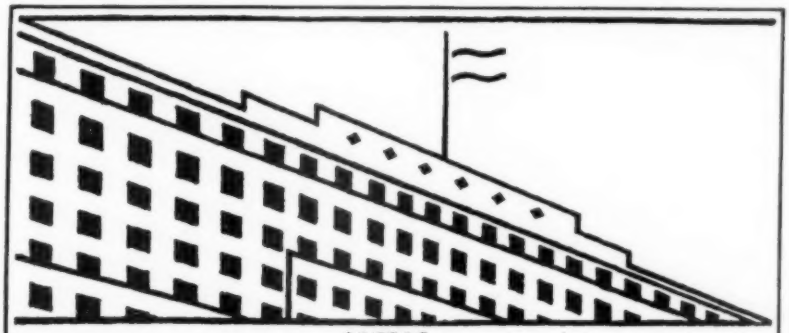
Therefore the lift full scale is 2400 times the lift of the model.

Thus 2400×1 lb. $= 2400$ lb. $=$ lift full scale.

And the drag likewise $= 2400 \times 1/12$ lb. $= 200$ lb.

The center of pressure location on the model is not always directly above the spindle and the resultant force then tends to turn the model around the spindle. The resultant twisting moment about the spindle is measured down below by weights on the moment arm. As we know the resultant force for any angle from our lift and drag readings, we can compute the distance from the spindle at which this force must be acting to cause a given twisting moment. This distance then determines the center of pressure for a particular angle of attack.

Models may be tested quickly and cheaply in the tunnel and such tests give accurate results. Changes in the model



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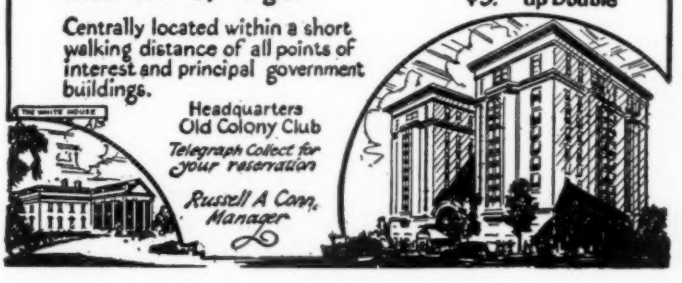

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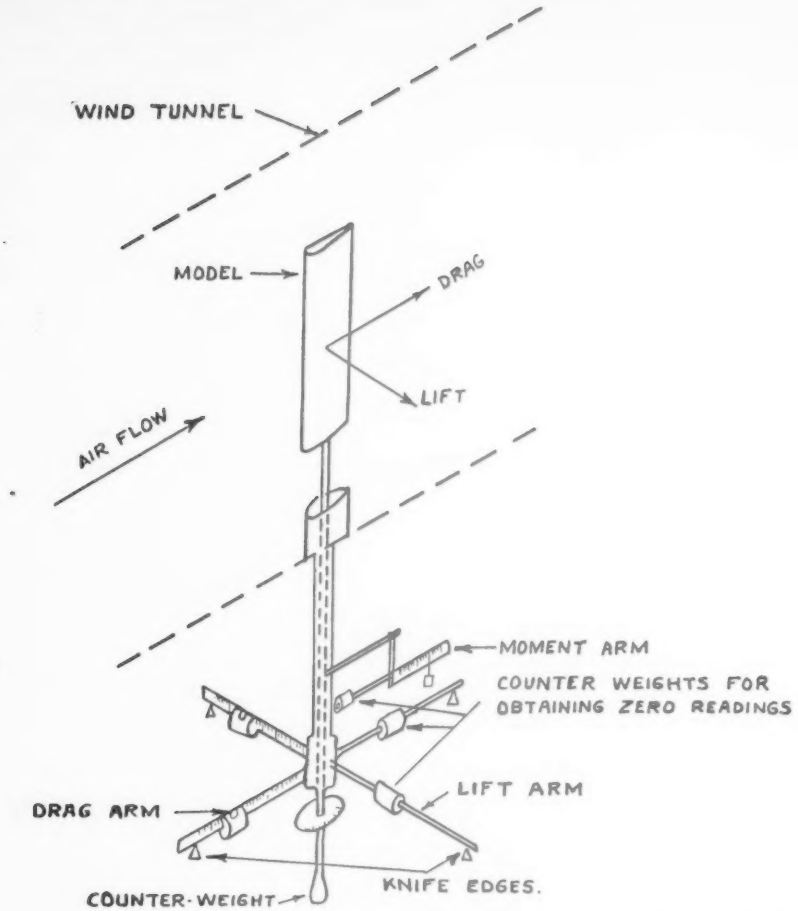


Fig. 6. Wind tunnel balance.

may be made and modifications tested at a very small expense. This is particularly important in obtaining the required stability for a new design. To make such modifications by cut and try, on the full-sized airplane, is dangerous and costly.

Pressure Distribution Around a Wing

Still another important method of experimentation in aerodynamics is the study of pressure distribution. Fig. 7 indicates diagrammatically the method employed in studying a wing. Tubes are led along the upper and lower surface of the wing, with small openings flush with the surface. The tubes are connected with a series of gages or manometers. All the holes, except those actually being studied, are closed up with wax or cigarette paper. The readings of the manometers are photographed. It is possible by suitably arranging the holes, and opening up a certain number at a time, to study the pressure at any cross-section of the wing, and also along its span.

Fig. 8 shows the pressure distribution for a typical wing at various angles of attack, on both the upper and lower surface. These pressure distribution diagrams are very instructive. They indicate first of all, that it is the suction of the upper surface of the wing which contributes the major portion of the lift. The second conclusion is that at small angles of attack, it is the rear portion

Fig. 7. Diagrammatic sketch showing method for measuring pressure distribution.

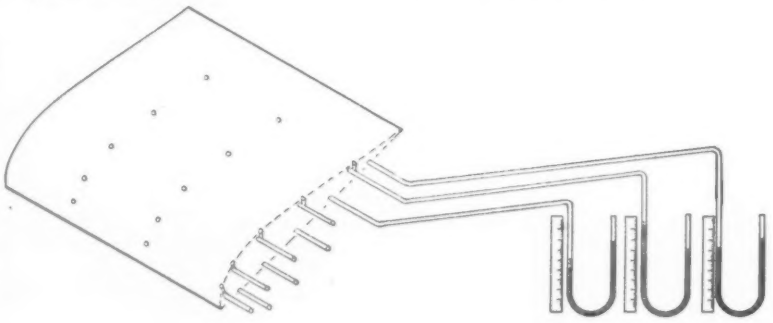


Fig. 8. Pressure distribution for a wing at a small angle of attack.

of the wing which has the greater concentration of force acting on it. At large angles of attack, the concentration of force and the center of pressure evidently move forward.

Properties of Flat Plates

Force measurements in the wind tunnel confirm the deduction already made from visual studies, that a flat plate is aerodynamically inferior to a cambered airfoil.

The outstanding characteristics of flat plates are as follows:

a. The maximum efficiency or L/D ratio is only 7.6 (as compared with as much as 20 for a good airfoil).

b. The lift is zero at zero angle of attack and reaches a maximum at about 30 degrees angle of attack. The maximum K_F value obtainable is approximately .00206. This value is comparable with that of a medium lift wing section.

c. As might be expected, the center of pressure moves from the leading edge at zero degrees to 50 per cent of the chord at 90 degrees.

There is a structural reason also for the unsuitability of a flat plate, and that is its

Fig. 9. Clark Y wing section.

lack of thickness. It is impossible to house in a flat plate a wing spar of sufficient strength.

Properties of a Typical Wing Section

In Fig. 9 we have drawn the outline of the Clark Y, an excellent and typical

wing section. The aerodynamic characteristics of this section are plotted in Fig. 10. These curves were obtained by testing a 36x6 inch model in the tunnel at a wind speed of 40 m.p.h., and include the lift and drag coefficients, the L/D and the position of the center of pressure all plotted against angle of attack.

The curves of lift and drag plotted against angle of attack correspond to what might be expected from a study of the sketches of air flow. As the angle of attack increases, the flow of air is deflected more and more from its original path and both lift and drag are increased. The Clark Y section reaches its "burble" point at 14 degrees. It can be seen from the curve that beyond 14 degrees, the lift falls off quite sharply.

It should be noted that the lift coefficient is not zero, at zero angle of attack. It would only be zero for a flat plate, or a symmetrical double cambered section, because even at zero incidence, there is still present a deviation of the air flow. It is only at —5 degrees incidence, when the nose is well down that the lift becomes zero.

Another important point to be noted on the curve is the minimum K_x or drag coefficient. A small value of the minimum K_x is particularly important for high speed planes, which fly at small angles of incidence in the region of top speed. The minimum K_x of the Clark Y is only .000035.

The point of maximum L/D, whose value is 21 occurs round 1 degree, whereas the angle of minimum K_x is about —3 degrees, at which angle the K_y is too small to give a high L/D ratio.

A pilot always lands his plane at the angle corresponding to the maximum lift, so as to land as slowly as possible. The Clark Y is quite an efficient wing, with its maximum L/D of 21, but its maximum K_y is only moderate in value —namely .00318.

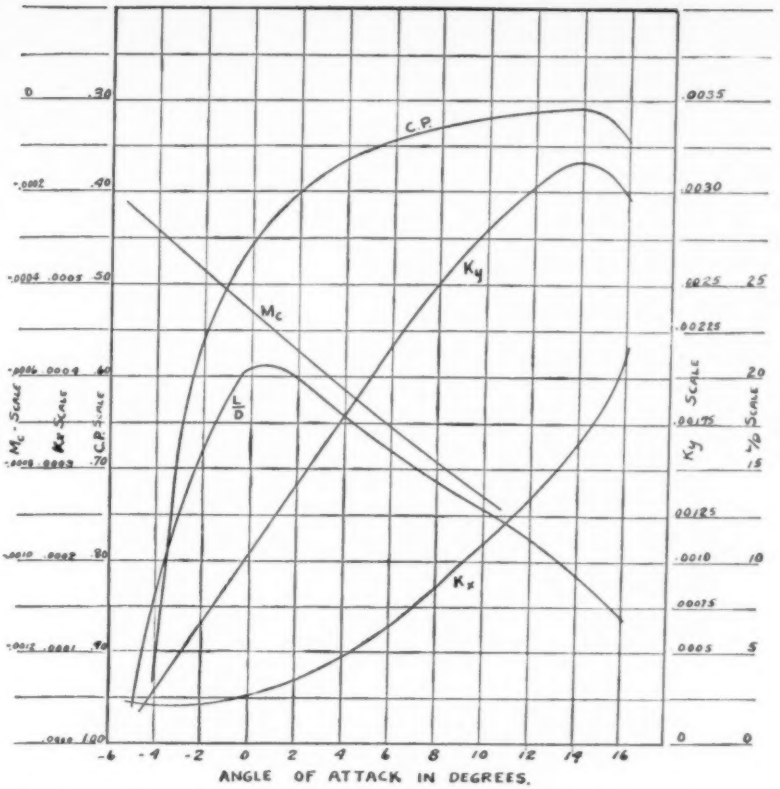
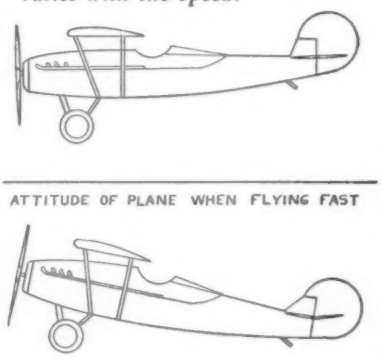


Fig. 10. Characteristic curves for Clark Y airfoil.

The center of pressure movement of the Clark Y agrees with what we would deduce from the curves of pressure distribution. At high angles of incidence, it moves forward, with 30.5 per cent of the chord from the leading edge as its most forward position. As the angle of incidence diminishes, the center of pressure moves backward. As we shall see later, too sharp a movement of the center of pressure is undesirable both from a stability and a structural point of view.

Fig. 11. The angle of attack varies with the speed.



Simple Relations Between Wing Lift, Drag and Speed

If a plane with a constant weight and area is to fly slowly it must fly at a large angle, where its coefficient of lift is large, to make up for the loss of lifting capacity due to the slow speed. Thus when a plane lands it is flying at a slow speed and a large angle of attack. The drag at large angles is great and slows the plane up quickly after landing.

If the same plane is to fly fast it must fly at small angles. Here the drag is very small and although the coefficient of lift is likewise small the greater velocity supplies the necessary lifting force to maintain flight. The attitudes when flying fast and when flying slow are illustrated in Fig. 11.

Some simple equations for wing lift, drag and speed may be written as follows:

To maintain horizontal flight the lift on the wings of an airplane must equal the weight of the plane (W). The equation $L = K_y A V^2$ then becomes:

$$W = K_y A V^2$$

This can be expressed in four useful forms:

$$(1) \quad K_y = \frac{W}{AV^2}$$

$$(2) \quad V = \frac{W}{K_y A}$$

$$(3) \quad A = \frac{W}{K_y V^2}$$

$$(4) \quad W/A = K_y V^2$$

From these equations we can deduce with greater assurance the fundamental relations between the speeds and angles of attack at which an airplane is flown, remembering that for any airplane the weight and area are constant.

When the speed V is large it follows from equations (4) that K_y must be small which can only be at a small angle of attack. At high speeds the angle of attack is in the vicinity of zero degrees.

(*Continued on page* 89)

Dangerous Seaplane Landings

By Thomas Carroll

Chief Test Pilot, Langley Memorial Aeronautical Laboratory, National Advisory Committee for Aeronautics.

A PECULIAR phenomenon in seaplane landing is observed and reported. The seaplane having executed a normal fast landing at low incidence a forward movement of the control stick effected an unusual condition in that the seaplane left the water suddenly in an abnormal attitude. The observations describing this phenomenon are offered as a warning against possible accident and as a conjectural cause of seaplane landing accidents of a certain kind.

During the investigation of the pressure distribution on the bottom of the pontoon of a seaplane, the Vought UO-1 with Wright Whirlwind engine which comprised an exhaustive routine of landings, take-offs, taxying, etc., a very peculiar phenomenon was observed with abnormal consequences. It was evolved in the following manner: On fairly smooth water and directly into a moderate wind, the seaplane was landed at low incidence, fairly fast, with part power on. Some discussion among the personnel handling the tests as to the condition which would produce the maximum positive pressures on the forward part of the pontoon indicated that this might be attained by pushing forward on the control stick during this condition of landing. Consequently, during the landing of this character under the conditions above stated the control stick was pushed rather suddenly forward a distance of about six inches. With considerable abruptness the seaplane appeared to rock forward onto the "toe" of the pontoon and then leave the water, "bouncing" to a height estimated by observers from the beach to be about 10 feet. During this "bounce" there was no tendency for the nose to rise as in the more usual "porpoising" condition, the feeling being that the airplane was traveling at a small negative angle of attack. At the top of the "bounce" there was a tendency to nose over, which was counteracted with some difficulty by the elevators; and a rather poor pancake landing with the tail only moderately well down was then made, the engine failing to pick up when throttle was applied.

A number of attempts were made to duplicate the conditions as in the first effort, with consequences generally similar but of varying intensity and slightly modified behavior. It is evident that such procedure applied by a pilot of small experience on seaplanes might produce unpleasant results, and it is suggested that landing accidents can be recalled where these conditions may have obtained which have resulted in the seaplane nosing in after the initial "bounce" with considerable injury to the airplane and its occupants.

It is thought that in some types of seaplanes where the controls are statically heavy and particularly in types with wheel control that the landing having been made in the so-called "hot" condition and while the seaplane is running along with exceptional smoothness although somewhat fast, the impression conveyed to the pilot is one of a com-

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pleted landing. In such a case should the pilot release his hold on the controls it might easily occur that the static weight would be sufficient to effect the dropping of the elevators to an angle which would produce this phenomenon and should the pilot have turned his attention and his hands to the adjustment of goggles or other gear, that he might not regain control sufficiently to overcome "nosing in."

From the pressure distribution records which were obtained on one such case it is interesting to note that the positive, upward pressure on the bottom of the pontoon was very high compared with other conditions of water maneuvers which, coupled with an upward aerodynamic load on the tail plane, provides the impetus for the "bounce" which ensues.

It is concluded that to avoid the dangerous consequences of allowing this condition to develop, careful maintenance of control throughout the landing is essential.

Simple Aerodynamics

(Continued from page 87)

When landing, the pilot flies the ship as slowly as possible. Thus V is small and K_Y must be large which means an angle of attack near the burble point of the particular wing used.

At "cruising speed," when above everything efficiency is sought, the pilot flies the plane as near the angle of greatest efficiency (best L/D) as possible.

It also follows that if a machine has a very large wing area for its weight, it will land slowly and fly slowly. On the other hand a small area relative to its weight indicates a fast flying ship. Thus transport planes have large wings and racers very small wings.

The drag of a wing $D = K_YAV^2$. In horizontal flight $L = W$.
Then $L/D = W/D$

whence $W = D\ (L/D)$ and $D = \dfrac{W}{(L/D)}$

Or in other words the drag of a wing at any particular angle of attack is equal to the weight of the plane divided by the L/D ratio at that angle.

Example

A monoplane with Clark Y wing has an area of 200 square feet and flies at 80 miles per hour at an angle of attack of 6 degrees. What is the weight of the airplane and the drag of the wing?

From Fig. 10, $K_Y = .00215$ at 6 degrees.

$W = K_YAV^2 = .00215 \times 200 \times 80^2 = 2752$ pounds.

$L/D = 16$ at 6 degrees.

(Continued on page 92)

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Foreign Aeronautical Notes

THE government of India has invited tenders for the operation of a weekly air service on a subsidy basis between Karachi and Delhi, and for an extension of this service to Calcutta. The closing date for receiving tenders was set at January 31, 1929. Under the terms of the government instructions to tenderers, bids may be offered for the service from Karachi to Delhi with or without a liability for an extension to Calcutta. The successful bidder will be given a contract for the transportation of air mail on the terms stated in the conditions of the contract. It is understood that the contract will be awarded only to an Indian company, with rupee capitalization, and controlled by an Indian majority of members on the board of directors.

The Bengal Air Transport Company (India) has been converted from a private limited liability company to a public limited liability company, and a statement in lieu of prospectus has been filed with the Registrar of Joint Stock Companies. The authorized capital of the company is 1,000,000 rupees ($370,000) in ordinary shares of 10 rupees each. The scheme to link Calcutta by air with Assam points and the port of Chittagong on the east coast of Bengal, has now taken definite shape with the formation of a company which intends to begin regular passenger and mail service early next year. There will be a fleet of 8 planes used on two services. One will connect with the English mail to leave Calcutta for Shillong and other Assam towns each Sunday. The formation of this company is the result of the interest stimulated by the many tours undertaken by Capt. B. M. S. Leete in his Moth to ascertain the possibilities of commercial aviation in India.

Considerable activity in aviation has taken place in the Far East recently. Flights have been made, companies have been organized, and regular services have been established in several countries of the Orient. General Chang Wai Wung, Chief of the Canton Aviation Bureau, aroused much interest in the possibility of establishing a transport service in China by his flight from Canton to Peking. Using an American monoplane with a 220 h.p. motor, he made the journey in three hops. The first leg of 500 miles, from Canton to Hankow, was completed in about 6 hours. The second, of 300 miles, from Hankow to Nanking was done in 3½ hours. The final stage of 575 miles between Nanking and Peking occupied 8 hours. Plans for a non stop flight from Canton to Peking have been nearly completed.

A non stop flight from Tientsin to Shanghai was made by Commander Chang on December fourth, in 5 hours and 55 minutes. The interest stimulated by these and similar flights has resulted in definite plans for the development of commercial flying in China. During December contracts were signed for the purchase of five American planes and four British Moths.

A charter has been granted to the Netherland Indian Air Navigation Co., Inc., for the purpose of operating a commercial service within the Dutch East Indies. The charter provides that the company shall have power to conduct a commercial aeronautics enterprise in the largest sense of the phrase, and to establish regular and special services for the transport of passengers or freight between places in the Colony and in the neighboring countries. The company is also authorized to engage in financial operations connected with its purpose, including the acquisition of stock in companies organized with similar aims. The authorized capital of the company is 10,000,000 florins ($4,000,000), divided into 400 shares of 25,000 florins ($10,000) each. 199 shares have already been issued, with 15% paid in, so that the paid in capital is 746,250 florins ($298,500). Each share of 25,000 florins can be divided into 25 shares of 1,000 florins each ($400). The charter provides that profits will be divided so that 6% of the paid on capital will first go to the shareholders, or as much as it is possible to pay.

Under the name of "Societe d'Etudes et d'Entreprises Aeriennes en Indochine et en Extreme-Orient" a new air company has been formed to carry on aviation enterprises in French Indo-China. It has a capital of 600,000 francs ($23,640) composed of 6,000 shares of 100 francs each. The capital will be increased to 2,000,000 francs ($78,800) by the issue of 14,000 shares of 100 francs each. 1,000 founders' shares also have been created with the right to 25% of the profits.

Aeronautical activity in Europe has not been curtailed to any considerable extent by the arrival of winter. The Berlin-Dresden-Prague-Vienna air service will be maintained without interruption so far as possible all winter long. The service is as follows: Leave Berlin 10 a. m.; arrive Dresden 11:15 a. m.; leave Dresden 11:30 a. m.; arrive Prague 12:40 p. m.; leave Prague 1 p. m.; arrive Vienna 2:15 p. m.; leave Vienna 10 a. m.; arrive Prague 12:15 p. m.; leave Prague 12:35 p. m.; arrive Dresden 1:45 p. m.; leave Dresden 2 p. m.; arrive Berlin 2:15 p. m.

Two services now connect Copenhagen with the continent. One of these is a German line to Hamburg, and the other is a Dutch line to Amsterdam.

The Rumanian Civil Air Lines have increased their services, calling more frequently at Bucharest, Cluj, Kischineff, Galatz, Jassy and Czernowits. The lines use six "Avia B. H." 25, and three Farman planes, all furnished by the Ministry of War. The Minister retains control of the commercial service.

Tri-motor Fokker monoplanes are used in the Rome-Milan air service, recently inaugurated. The planes leave Rome on Mondays, Wednesdays and Fridays at 12:30 p. m. and arrive at Milan at 4 p. m. On the same days planes fly from Milan at 12 o'clock noon, and arrive at Rome at 3:30 p. m. The passenger fares are as follows: One way trip, 350 lire ($18.40); round trip, 650 lire ($34.20); ticket for 6 trips in either direction, valid for two months, 300 lire per ride ($15.80); for 12 trips in either direction, and valid for three months, 290 lire per trip ($15.30); for 24 trips in either direction, valid for 6 months, 270 lire ($14.20) each way. There is also a monthly pass issued, for an unlimited number of rides within the expiration period, at a flat rate of 2,000 lire ($103.30). Merchandise is transported at the rate of 3.90 lire ($0.21) per kilo, and there are no special restrictions covering such service.

During the year 1928 very notable activity has taken place in Italian air passenger transport. 20,000 passengers have been carried during the year, a figure about double that of last year. During the month of August, on the Brindisi-Athens-Constantinople air line planes flew 26,588 kilometers carrying 138 passengers, and 4,984 kilos of mail, baggage, and merchandise. This line, now in its third year of operation, is reported to have maintained 100% regularity of service, with only one serious accident, in which a mechanic was killed.

The Deutsche Luft Hansa Aktiengesellschaft will take advantage of the quieter winter months as usual to give their pilots another series of special training courses. All of the spare pilots, with the exception of those taking the compulsory sea flying course at Travemunde, have been summoned to Berlin to take part in discussions and informational courses. These courses deal particularly with technical air matters, and include the study of ground organization, night flying, route marking, meteorologic information, radio, passenger and freight service, and other commercial affairs. Special stress is laid on the discussions of experiences in actual flying practice, and

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South America reports several important developments. The Compagnie Generale Aeropostale (Brazil) has been empowered to carry printed matter, samples, and goods in their machines. A super tax of 30 cents will be charged for every 50 grams or fraction thereof. The company is also to undertake an ocean letter service which will consist of a radio delivery system, the radio messages to be delivered to the flyers in the form of letters from ships belonging to the company, and taken by air to their destination. This is in the nature of an experiment, and the actual practical value of the service is yet to be established.

The government of Uruguay has authorized a subsidy for the maintenance of the Montevideo-Buenos Aires air service. The subsidy consists of an appropriation of 25,000 pesos ($25,400), to which will be added the revenue from the extra air mail postage. It may be used at the rate of not to exceed 150 pesos ($153) daily for each round trip flight. The only company to be benefited by the subsidy at this time is the Compania de Taxi Aereo. This organization operates a daily mail express and passenger service between the two capitals, with departures in the morning from Buenos Aires and in the afternoon from Montevideo. As matters stand, practically no time is saved patrons flying from Uruguay. In order to correct this deficiency it seems probable that a Uruguayan company may be formed to offer a passenger service from Montevideo on a schedule which will allow passengers to take advantage of the business day in Buenos Aires.

On April 1, 1929, the French company Latecoere expects to begin an air service between Buenos Aires and Antofagasta. The company has a contract with the government of Chile which will make it possible to extend its France to Argentina line to Chilean points.

After a series of successful experiments with a flying service between Montreal and Quebec, the Ottawa Post Office Department issued an official order making Quebec the terminus of the Eastern Air Mail Service for the rest of the season. An announcement has also been made that Quebec is to be the base of operations on the "Seven Isles Flight" instead of Lake St. Agnes. The new flight, which replaces the Montreal-Rimouski service, will be made every week end, the mail being landed at the St. Foy field and transferred to the liner in the harbor just prior to sailing.

A new airport has been built at Travemunde near Lubeck, Germany, by the Hanseatic Hydrodrome Co., Ltd., which because of the accommodations it offers both land and sea planes is of unusual importance. The first section, which has

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been in course of construction for a year and a quarter, is now complete. The cost, which amounted to approximately 2,000,000 marks ($476,000), was borne jointly by the German government and the Free Cities of Hamburg and Lubeck. About 600,000 marks were spent on the flying field and hangars. Hamburg's active cooperation has been mainly responsible for the rapid completion of the section. The municipal Director of Buildings was placed at the disposal of the Hanseatic Hydrodrome Company, with the result that a minimum of waste effort was expended in carrying the project to completion.

Simple Aerodynamics

(Continued from page 89)

Drag of wing $= \frac{W}{L/D} = \frac{2752}{16} = 172$ pounds.

Questions and Problems

1—Define "burble point". At about what angles do ordinary wings burble?

2—What is K_y? In what units is it expressed?

3—Why does a plane land at a large angle of attack?

4—A wind tunnel model of a Clark Y airfoil has an area of 18×3 in. $= 54$ sq. in. It is to be tested at 40 m.p.h. What will be the lift on the model at an angle of attack of 6 deg.?

5—A 200 sq. ft. wing of Clark Y section is designed to land at 50 m.p.h. What weight can it support? (Use K_y maximum.)

6—A monoplane with a Clark Y wing has an area of 200 sq. ft. and flies at 80 m.p.h. at an angle of attack of 10 deg. What is the weight of the airplane? The drag of the wing?

7—If the wing of an airplane has a 6 foot chord, and a Clark Y wing, how far from the leading edge will the center of pressure be at (I) 12 degrees incidence (II) 4 degrees incidence.

Answers

1—The burble point of a wing is that point where its lift is a maximum. Most ordinary wings burble between 12 and 18 deg.

2—K_y is the coefficient of lift in Engineer's Units. It is expressed as lb. per sq. ft. per m.p.h.

3—A plane lands at a large angle of attack because at those angles K_y is large and flight can still be maintained even though the speed is very small.

4—1.29 lb.

5—1590 lb.

6—W = 3540 lb. D = 272 lb.

7—(I) 22.3″
(II) 26.3″

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Lighting as a Safety Aid

(*Continued from page* 60)

lantern with 200 watt lamps and red globes is suitable for tower obstruction lights. Marking the span across navigable waters is required, but presents several difficulties in connection with proper maintenance. The indirect marking of the span by high intensity projected light beams from the tops of the towers along the span is suggested, using

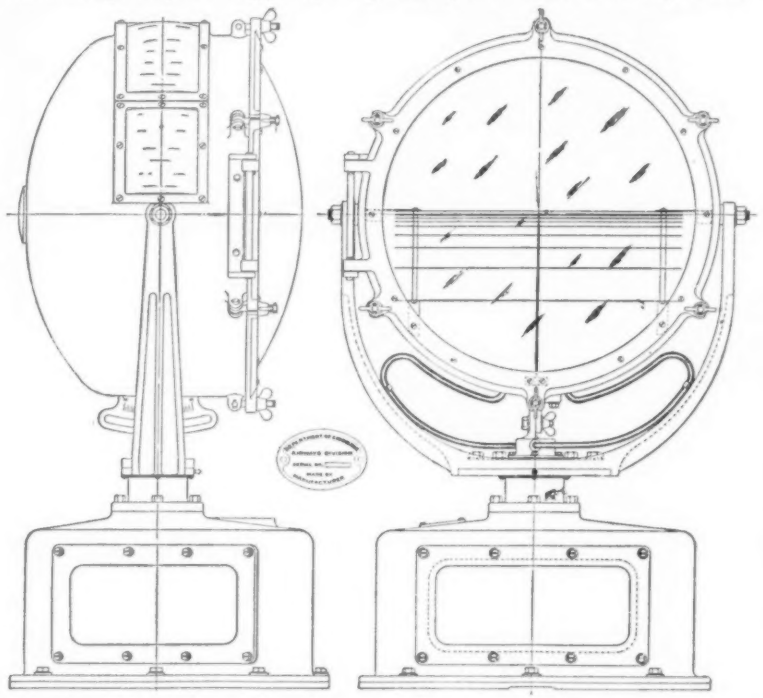

Fig. 4. Side and front elevations of the new 24 inch revolving airway beacon.

14 inch ceiling light units with 250 watt low voltage lamps for spotlight service.

It is suggested that the Federal Radio Commission be prevailed upon to require the painting of all radio towers to increase visibility and to insist upon their being lighted with, for example, 100 watt red lamps in waterproof glass globes at the top and at points 1/3 and 2/3 from the tops of towers, the lights being visible from any angle of approach. All radio stations operate on licenses issued under the authority of the Federal Radio Commission. If necessary, proper legislation should be passed to assure safeguarding airplanes in flight from the hazards of radio towers. The marking of high lines at intersections with an airway is needed to safeguard airplanes in flight and this requirement is taken into consideration in laying out the airway lighting system. It would facilitate lighting if neon high voltage lamps of 10,000 hours life were available for installation on high tension lines using lamps built for the voltage carried by the high line. The intersection of the airway with the high line could then be marked for the full width of the intersection and would facilitate and cheapen the maintenance of a more adequate lighting system.

The marking by owners, of obstructions not in the navigable air space, is not required according to present policies, except bridges, transmission lines or other obstructions spanning rivers, used during bad weather as airway routes.

Matilde Moisant

(*Continued from page* 52)

probably saved her from the same fate that not long thereafter claimed Miss Quimby's life. Her brother, to tempt her out of her desire, offered her a plantation in San Salvador if she would go there and live. She accepted, and thus her flying career was ended.

Although flying exhibitions at that time attracted much public interest, promotors were subject to so many vicissitudes that they were seldom financially profitable. I kept on going with the aviation troupe for a considerable time after Miss Moisant left us, but we felt the loss of our chief attraction. The great international company with its school did much to keep alive the public interest in aviation until the world war came on and created a new era for that and many other lines of human endeavor.

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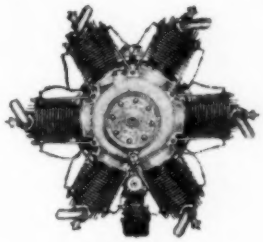

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Lieut. James E. Dyer, U. S. N., winner of the Schiff trophy as the year's safest Navy flyer.

LIEUT. JAMES E. DYER, to whom President Coolidge in December presented the Herbert Schiff trophy for having flown 1253 hours during the last year without an accident, attributes his success to an "excellent mechanic," W. F. Leland, a machinist's mate first class. Dyer is the fourth naval officer to win the Schiff trophy. Lt. Reginald Thomas, then stationed at Squantum, Mass., was first. Capt. H. Denny Campbell of the marine corps, then stationed at San Diego, was second. He was followed by Lieut. Arthur Gavin, at Philadelphia, succeeding Captain Campbell.

Now that Dyer has succeeded to possession of the trophy, the bureau of aeronautics has ruled that in the future competition in the navy will be conducted by squadrons. This Lieutenant Dyer considers a good move, he said, in that it will broaden the scope of the competition and make every flying squadron eligible to win the trophy. He was able to win it, he explained, because he was instructing students at the North Island Naval Air Station and was forced to spend several hours every day in the air.

Dyer considers acquisition of the trophy "just routine." His work in naval aviation since he first entered it in 1917, has been largely routine. This includes his experiences in the lighter than air branch, wherein he served during the war at Pauillac, Brest, Guijan and elsewhere in France. He has served at most of the navy air stations in the United States and has spent 3200 hours in the air. His record approaches the 3400-hour record of another navy flyer, said to be the maximum for navy pilots to date.

During the last 1200 hours of this total, Lieutenant Dyer has given dual instruction to 107 students. These are both regular navy officers and reserves. Many of them are ensigns, fresh from the naval academy. Apropos of this personnel, Dyer stated recently he has noted a considerable change in present-day student flyers. Most of them in military and naval circles are college men, he said, and they enter the flying service with a full understanding that there is far more to learn than merely to handle a plane in the air. Thorough training combined with excellent equipment aids materially in increasing safety generally in aviation, he believes.

While he has won recognition as being the safest pilot in the navy, Dyer said that there have been times when he could not qualify.

"In 1920," he said, "I certainly would not have been eligible for the Schiff trophy. At that time I was stationed at Coco Sola, attached to a non-rigid lighter-than-air squadron. One day we went up in the C-9 for a test flight. We cruised a little while at 1500 feet, then descended for a landing. Everything ran smoothly until we were 25 feet above the ground. Then the C-9 ripped open a distance of 85 feet and—kerplunk!—down we crashed. The non-rigids are made of rubberized fabric. This deteriorates rapidly in the tropics. While that explains our accident, it wasn't very pleasing.

"Again three years later on a flight between Panama and Venezuela we encountered heavy seas. We were flying an F51, a twin-engined plane, and had landed in the heavy seas several times for repairs, when suddenly one engine quit. Naturally we made a forced landing! The crew of five rigged sails out of shirts and tried for 48 hours to beat our way to land. In the midst of sharks and high seas we were anxious enough to reach land and certainly did welcome a destroyer that appeared at the end of the second day to pick us up."

From Picks to Props

(Continued from page 38)

go the port engine stopped and we were forced to land in the Bay. Fortunately a rocker arm housing was among the spare parts and the motor was running again in less than thirty minutes. The only thing that kept the Admiral from pacing the "bridge" was the fact there was no "bridge." Having heard that one Admiral had a peculiarity of throwing his cap to the deck and jumping on it in tense situations, I was somewhat worried, until we again took off, over the safety of my 15 dollar goggles which I had loaned the Admiral.

When all of the students had completed the required number of solo hours we were sent to the rifle range for two days preceding the bombing and gunnery exercises. The first day scheduled for bombing practice was a windy one, with an occasional shower. Two students were to go in each plane accompanied by an officer as safety pilot. The bomb-racks, one on the under side of either wing, were loaded with six sub-caliber bombs each, and the target was a raft anchored in the bay.

The students alternated as pilot and bomber and changed places in the air, as this procedure was more convenient than landing each time a change was made. It was practically impossible for one of large proportions to squeeze through the door connecting the pilot's and gunner's cockpits, so we climbed over the turtle deck, one going forward as the other came aft, passing mid way. Wing walking became a matter of course, and often one student would walk out to the end of the wing to take the other's picture. Our bombing was by no means accurate nor did we become very proficient with the little practice we got.

Gunnery was the most interesting of the practices. We fired both at stationary ground targets and at moving targets. One student became so intent on hitting his shadow on the water that he shot three holes through keelsons of the hull. Another took the empty-cartridge bag off and proceeded to stand up and gently shake the empty shells out into space. One bounded off the pilot's head into the propeller, causing it to split its entire length. By throttling the motor down, they were able to return to the station.

The lighthouse keeper at Newport News Middle Ground Light, was a friendly old fellow and often times there would be two or three planes on the water alongside the light, paying the

keeper a visit. We often congregated in unfrequented nooks of the bay to "shoot the breeze" and smoke, until we saw a plane in which we thought an instructor might be and become too inquisitive, when there would be a mad scramble to get into the air again. Other times we would take a swim. One day, one of the boy's planes drifted away from him faster than he could swim. He was picked up by another student who was standing by watching, and who gave chase to the drifting plane.

Jim was attempting to taxi up to a runway one day with a fresh cross wind blowing. He misjudged his drift, missed the runway, and was headed directly for the sea wall on which Red and I happened to be standing. Becoming excited and confused he left his motor turning up about eight hundred revs and climbed out on the bow in an attempt to keep the plane from crashing into the sea wall.

"Cut the switch," we shouted in chorus, but the motor drowned our voices. The left wing was about to strike first and we made a grab for it, but it was coming with such force that Red was knocked down and dragged for several feet as the overhang of the upper wing swung in over the edge of the sea wall. By this time Jim had gone back and cut the switch, and Red picked himself up and told Jim, in none too polite terms, what he thought of him. To this day, Jim is a trifle embarrassed when reminded of the incident.

There were no accidents among the students but the instructors did their share. One officer landed on the submerged wreck of a destroyer lying in shoal water just off the end of the Spit. The hull of the plane was literally cut in half, but no one was hurt. Another instructor was forced to land on some mud flats from which the tide had just receded. No damage was done, but the mechanic who was standing in the bow was catapulted head first into the soft mud thirty feet ahead. The plane had to be disassembled and brought back by truck.

Another 45 day training period was nearing its end. According to the training syllabus we were supposed to receive instruction and solo in F-5-L's. We got about five hours apiece, but did not check out.

The F-5-L was a twin engined flying boat powered by Liberty motors. It carried a crew of six men, two pilots, a gunner, a navigator, a mechanic, and a radio operator. It had a wing span of one hundred and two feet, and weighed in the neighborhood of six tons.

The last week was spent taking ground school and professional examinations for commissions. Whole volumes were written that week. Essays on how to time

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a Liberty motor, pages on Naval Courts and Boards, theses on Theory of Flight, Sketches on everything difficult to explain, and words upon words of plain bunk. Midnight oil was consumed by the bucketful, notebooks bulged with newly acquired knowledge, arguments ensued. What is dihedral? Who can convene a General Court Martial? Describe the action of a Lewis machine gun, etc., ad infinitum.

When Friday finally arrived, we were mentally fatigued, but we felt physically able to do justice to the "binge party" we had arranged as a farewell to our officers and as a celebration of the completion of our exams. The party was a huge success. There were twelve students and twice as many officers.

It was not an easy task to return to that little college in northern Illinois and settle down to the resumption of a tame college curriculum, after having spent three and one half months flying.

By November 1, I had received orders to report for a physical examination for commission as Ensign USNR, and a few days later was being fitted for a new uniform that was to have gold braid on the sleeves and most important of all, was to have a pair of wings over the left breast pocket.

The Flying Laboratory

(*Continued from page* 27)

Airplanes are noisy. There seems to be no way to suppress their uproar. The engine must run. The exhaust cannot be muffled without losing much-needed power. The propellers raise a rumpus in beating the air. The fuselage and wing covering is stretched like a drumhead and seems to magnify the noise. The wind shrieks past exposed wires. Inside a cabin it is as easy to converse as in an enclosed car, but radio signals are not always as strong as a human voice.

The airplane radio receiver must amplify the signals enough to make them heard above all this commotion. Mr. Sleeper, in The Flying Laboratory, has not found the problem of amplification especially difficult except as it has increased the complexity of the receiver. It is not necessary to produce loud speaker volume. A man who wants to use radio in an airplane is satisfied to have a pair of phones in his helmet.

More troublesome than the mechanical noise, however, is the electrical interference from the ignition system. In the Whirlwind motor there are nine cylinders, each equipped with two spark plugs—eighteen tiny transmitters sparking constantly. This ordinarily causes a steady rattle which sounds like very severe static. Most of this noise is eliminated by copper braiding over all the ignition wires, grounded to the engine and the metal frame of the ship, but the total elimination of engine noise is a serious problem.

When an airplane carries a radio man, or has a radio set for the use of passengers, any ordinary type of receiver can be used. The operator can tune in stations in the usual way and the only difference between using a set in a plane or elsewhere is the amount of the extraneous noise. It is like trying to bring in a concert in a room with a large and restless family.

When a set is to be used by the pilot, it is better to have it tuned permanently to approximately the frequency of the station that the pilot needs to hear. Mr. Sleeper has designed a set with but two controls, one being the tuning vernier and the other a knob to regulate regeneration.

In achieving simplicity, he uses batteries in preference to a generator for short-wave transmission and reception. Batteries to deliver the highest voltage required in such sets weigh less and operate more reliably than generators.

The Bureau of Standards has developed a visual indicator for aircraft radio beacon signals. It can be used with any receiver that can be tuned to the frequency of the beacon and that will deliver the moderate amount of energy required to operate the indicator. It is mounted on the instrument board of a plane and is as easy to read as the clock. The pilot sees two horizontal white lines, end to end, with a black space between. When he is exactly on his course, the lines are of equal length. If he swerves to the right, the line at the right lengthens. If he goes to the left of the course, the left line lengthens.

The same beacon may guide the ship away from it and toward it. The pilot merely turns the indicator upside down when he starts back toward the beacon. The indicator is mounted so that this can be done without difficulty.

An important question now is high power at 850 to 950 meters to transmit up to 250 miles, to cover the skip distance from a light-weight short-wave transmitter. For long flights both may be needed.

Direction finders on planes, to pick up short-wave transmitters up to 25 miles, may prove to be better than beacons because, if a pilot gets very far from the line of the beacon, he may not hear it. It would be practicable for a ground station to use an automatic phone transmitter that would speak the name of the station. A pilot who could hear two such stations could quickly plot his location. Or he could steer for one station after another along the route.

Airplanes in the near future may use also an automatic code transmitter, operated by pressing a button, by which a pilot can signal at intervals to ground dispatching stations or ask for weather reports.

As the work of The Flying Laboratory progresses, there is no doubt that radio aids to avigation will become available to an increasing number of aircraft.

A Civic Investment

(*Continued from page* 25)

ports, operated and maintained by the municipality, for general service; private airports, established by individual or corporate investment, to provide special services, receiving special compensation therefor.

Meanwhile, we need airports and the necessary land should be secured before the growth of our cities and the increasing difficulty of obtaining undivided parcels forces the cost higher. If we wait for private enterprise to provide airports, the eventual cost will be just so much the heavier, for capital investments will have to be larger. Therefore the purchase of an airport site today is not only an investment in progress but an actual economy on the part of almost any municipality.

Whether or Not—

(*Continued from page* 22)

formed. This temperature decrease may take place in many ways—by mixing with colder air, by losing heat through radiation like the cooling of a hot iron, by coming into contact with cooler surfaces of ground, water, ice, or layer of air, and by expansion, as on rising. Thus again, we see the great importance of temperature differences. A knowledge of humidity combined with other factors can predict fogs, clouds, and precipitation.

All of us know the value of water but we gain an even greater respect for water-vapor when we note the small amount of it which produces such enormous results. A suggestion of what this entire earth would be is gained by visiting in our imagination the great deserts. Absence of water-vapor is the cause. In the western part of the United States the air from the Pacific Ocean is robbed of its moisture as it passes over the high Sierra Nevada range. Thus the great desert is formed, but even this region receives some rain.

We have reviewed the primary elements of meteorology and we have found that temperature differences are of first importance because they make air-currents and all winds. Then water-vapor is the other great factor in weather. We may be disappointed occasionally with the changeableness of the weather, but after

all weather is change. Furthermore, without change we would have deadly monotony—a dead world. And when we worry or fret about the weather and consider it the worst enemy of aviation let us remember that the greatest civilized progress has been made in the temperate latitudes—where weather is quite variable and the climate is far from equable. There is something about the change—largely psychological and partially physiological—that makes us a people of action, of enthusiasm and of vigor. It was in a variable climate, in a region of changeable weather, that the airplane and its preceding and contemporary great achievements in science and in engineering were conceived and constructed. In tropical Africa where life is so easy that intelligence does not develop through need of it, no progress has been made by the primitive people for a million years. In our climate we measure our progress daily.

In closing, we might reflect upon the meaning of meteorology—"the things above." Is it not strange that meteors and comets engaged the attention of the early Greeks more than the more pertinent phenomena of the atmosphere? Is it not strange that ancient peoples knew a good deal about the far-off stars and practically nothing of meteorological elements? And then come back to the present and reflect that most persons' interest in the sky is still confined to the night sky. Why does not the average person know more of the day sky than he does, considering that it is of far more importance to him than the night sky even with its splendors and mysteries of stars? The day sky reveals today's and tomorrow's weather and it does so in a gorgeous, ever-changing panorama of beautiful clouds and sky. The things above are indeed as wonderful by day as by night and much more varied in effect and of infinitely more importance to us. Maybe these new "things above" —the marvelous aircraft of man's own making—will help to open our consciousness to the day sky as we gaze upward. And when we know weather well we shall respect it and like it.

"Over the Hump"

(*Continued from page* 18)

is laid on adaptability of the plane for carrying certain equipment, comfort for flyers, and other special requirements.

Seldom today is it necessary for Uncle Sam to hold prize competitions to get the plane he wants. He procures it through advertising for bids in the open market, or buys from a manufacturer a type especially adaptable to his needs. Although most of the planes he buys are experimental in character and destined to special uses an infinitely widened choice is now at his option. No longer is it a fast rule that new planes must be shipped in and assembled at the government experimental field. Oftener they are assembled at the manufacturer's plant, given trial flights at the manufacturer's field, and flown to the government field at time of delivery.

Sample parts are still carefully static tested during building, however, and unconventional parts still subjected to the wind tunnel. Nor is the system of flight testing after delivery any the less rigid. Recently a manufacturer and his chief engineer came to see the first flight of their new plane by Wright Field test pilots. The pilot who had ferried it to the field had spoken highly of its flying qualities. The engineer, unfamiliar with test-flight procedure, asked the test pilot to "take it up and toss it about a bit" for the number of spectators. The pilot replied that first he'd have to take it over the "speed course."

This is a two-mile straightaway course permanently laid out on the test field over which the airspeed indicator is calibrated and the plane's high and low speed definitely learned. The airspeed calibration and high speed tests look innocent enough to the uninitiated bystander, who sees merely a plane darting swift as an arrow in a straight line some ten or twenty feet above the ground. He does not know perhaps that there is danger in that extremely low altitude should anything happen to plane or engine, but that the pilot must keep to it because it is only there that he can get the stillness of air necessary for the successful performance of such tests. Nor does he see the strain of the flyer as he sits braced, scarcely daring to breathe for fear of upsetting the nice balance of the plane going at top speed, one hand on the stick, the other on the engine throttle, a stop-watch in the throttle hand held against slipping by having its cord wrapped between his fingers.

The low-speed test, after the former arrow-like swiftness, in which, in the open stretch of the great field, the plane seems scarcely to move, held just flirting with the stalling point, is much the more picturesque performance. The company's chief engineer became visibly nervous as he watched. "Does he have to crawl it like that?" he finally exclaimed. "Heavens, what a sweet mess if it dropped!" A pilot leaning in the window of the chief engineer's car smiled. "But it won't drop in that boy's hands," he reassured him. "He's just taking it 'over the hump.'"

That, it struck us, was what Uncle Sam had been doing during those years of testing, especially the first seven years after the war—taking the airplane over the hump.

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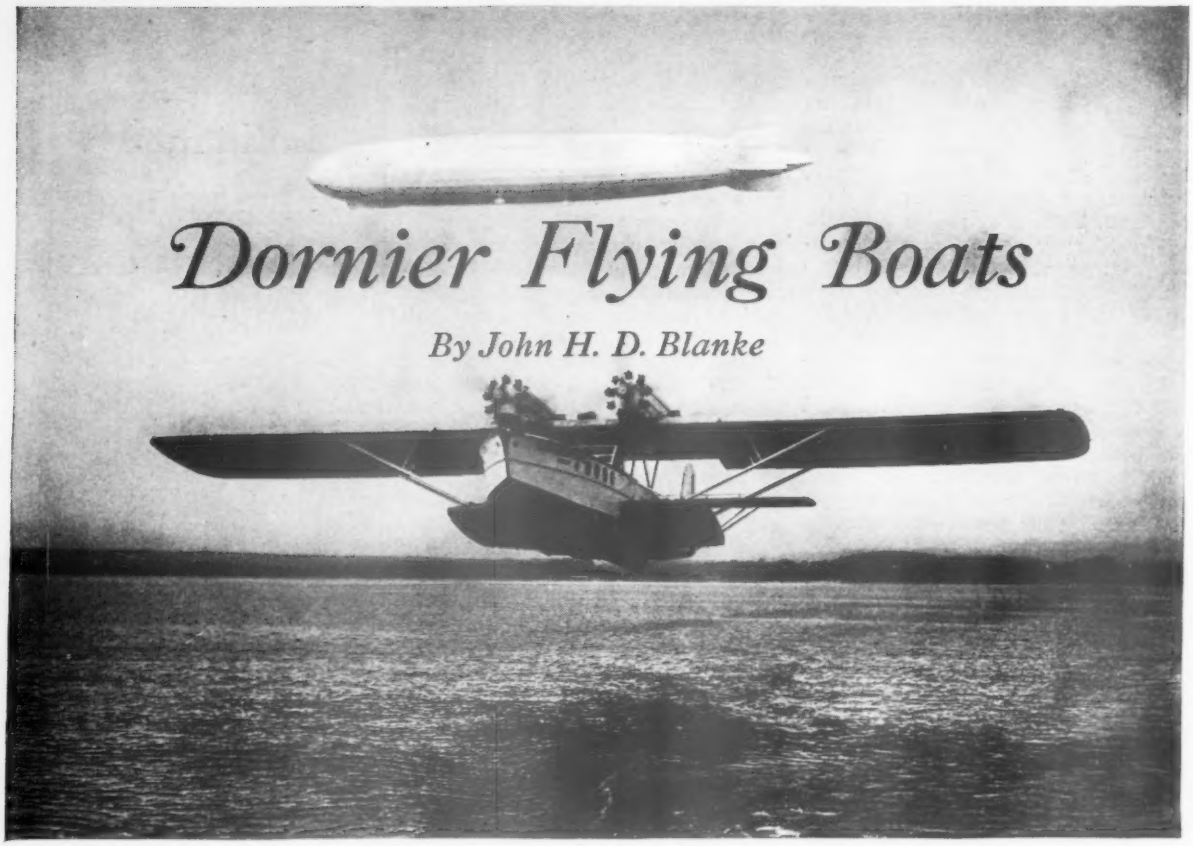


Dornier Flying Boats

By John H. D. Blanke

The Graf Zeppelin and a Dornier Super-Wal over Lake Constance

GRAF ZEPPELIN, the pioneer in modern airship development and the father of the design of the "Graf Zeppelin" that made the recent eventful flight from Germany to the United States and return, in the year 1914 urged his co-working engineer Col. Dornier to build giant airplanes. Dornier, out of his experiences in airship design, decided upon all-metal construction for his airplanes, selecting duralumin alloy, together with steel for all parts exposed to greater strain, although nearly all airplanes were at that time built of wood. His third airplane turned out to be an exceedingly able machine for front line service in the marine, for with the same carrying load it was 4,400 lb. lighter and 19 miles per hour faster than the wood-constructed planes. This success and the advice of Dornier led Prof. Junkers, designer of the plane that carried Koehl, Huehnefeld and Fitzmaurice to this country, to adopt duralumin also, after his iron-constructed plane had failed. Nearly all the construction principles established by Dornier in his pioneer work of airplane design have been retained by him to this day. It was merely a matter of applying and testing out the theoretical knowledge of airplane construction.

Dornier built his first airplanes in the small shipyard Seemoss on Lake Constance. Following the successes of the giant Dornier flying boat with which observation flights of 10 to 12 hours' duration were made, a larger ship or plane yard was erected at Reutin near Lindau to which was added a plant for manufacturing the metal floats. Then followed a larger plant in Zech near Lindau and when the Treaty of Versailles curtailed all further progress in airplane design, a factory was established on foreign soil, in Marina di Pisa. Here Dornier built the flying boat Dornier Wal with which Locatelli flew in 1924 from Italy to Greenland. The following year Dornier supplied Amundsen with several flying boats for his expedition to the North Pole, the outcome of which drew the attention of the entire world. Early in 1926 Franco used a Wal seaplane to cross the ocean. Of the many world records made by Dornier planes and accepted by the F. A. I., 18 were established with a Dornier Wal in the spring of 1925 by Wagner and Grossio.

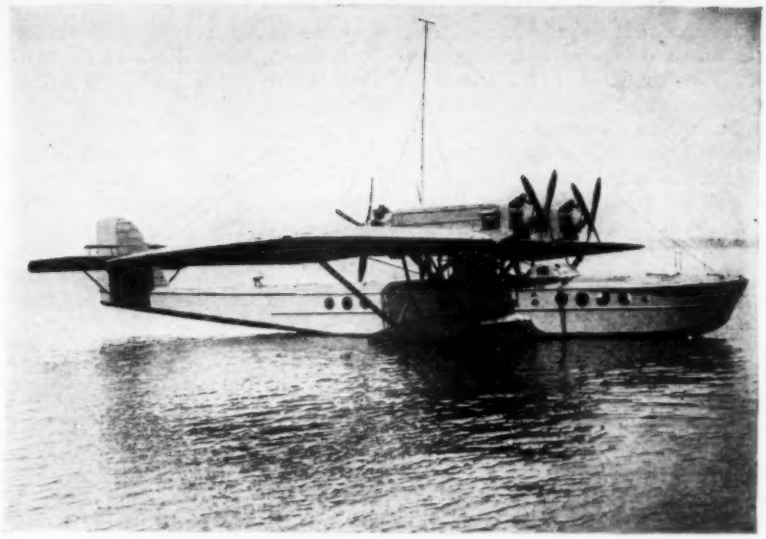
In 1923 Dornier purchased the shipyards of the Flugzeug-Bau in Friedrichshafen, but soon the capacity of this plant on German soil was insufficient for the demand and a large factory was erected at Altenrhein in Switzerland where Dornier provided also a large landing field for his land planes. Licenses were issued to concerns in various countries to build flying boats after the Dornier designs. On Feb. 8, 1922, "Aeronautical Engineering" stated that during the previous two years Dornier had created probably more airplanes of entirely new design and economies, than any other designer. And on June 24, 1926, the French periodical "l'Aero Sports" stated that "we must follow the method of design of Dornier accurately and determine the reasons for his successes in all those countries where our airplane industry runs into danger of losing out in competition, for the undeniable superiority of the airplanes from Friedrichshafen gives those countries an inclination to become customers of a plant that has important recommendations from Italy, Spain and Japan." There have been many imitations of Dornier design, such as for example the Aeromarine E O 1924, the Supermarine Schneider Type 1925, the Farman Jabiru F3X 1923, and the Farman F 170, 1925.

The German Aero Lloyd installed an all metal Dornier Komet II land plane on the Berlin-London route on New Year's Day 1923, which had a capacity of 6 passengers and used a single motor of 185 h.p. In 1925 the same type of

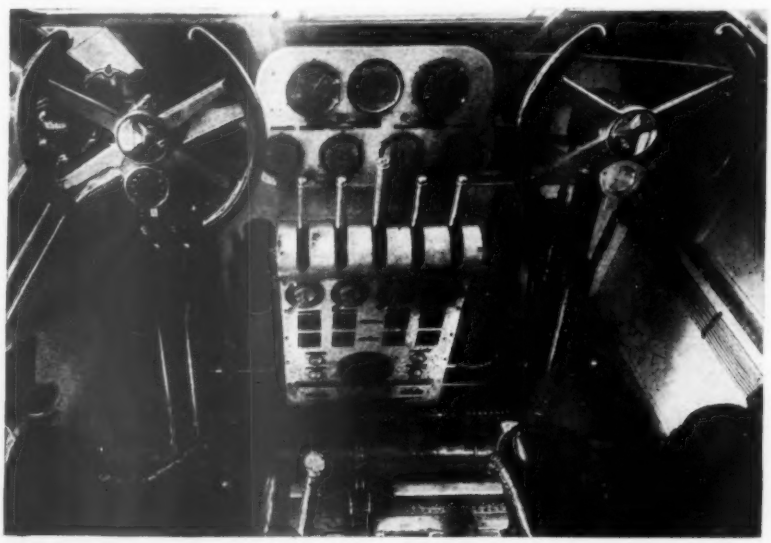
plane was installed on the Copenhagen-Hamburg-Zurich route and the Berlin-Amsterdam-London and other routes. Comparing all planes of the entire fleet of airplanes of the German Aero Lloyd, the seven Dornier Komets II covered 75% more flying distance, were 30% more dependable and 5% faster than any others. The Russian air transport company installed a number of Komet II planes on the Moscow-Charcow-Odessa route with connections from Kiev and Rostow to Charcow. Many Dorniers are used also in surveying in Russia.

The advantages of airplanes become much greater when used above the sea than above land, as compared with other means of travel, for while the traveling time on land is decreased to about 1/3 on the sea it is decreased to as much as 1/6 because of the relatively slow speed of steamships; hence the success of the flying boats of the Nordiska Flygreteriet on the Baltic Sea in carrying passengers. Dornier Wal planes are used regularly by the Scadta in Central America. In the fall of 1925 two Dornier Wals made a flight from South America across Cuba to North America, giving thereby initiation to the development of an extensive Central-American air transport. The Italian air transport company Sana employs six Dornier Wals on the Genoa-Rome-Palermo route now to be extended from Genoa to Barcelona. When Locatelli made his attempt to reach America from Italy by way of Greenland, he was forced down on the Greenland coastal waters where the pontoons of his flying boat kept him safe on the stormy waters for several days until rescued; a land plane would have gone down in a short time. Major Franco used a Wal "Plus Ultra" flying boat in crossing the ocean from Spain to Pernambuco, South America, in 35 hours and "Les Ailes" wrote on Feb. 18, 1926, that "if the Dornier Wal had not been just as good a ship as a flying machine, it would never have weathered the elements and the flight would have been discontinued in Fernando Norouha or sooner."

The landing of Courtney on a stormy ocean last summer while his Dornier flying boat was afire due to a broken feed pipe and his rescue long after the fire had been extinguished, in common with the experiences of others using flying boats, have shown that the use of such able sea-going airplanes as the Dornier flying boats is the only way to make flights across the ocean or long bodies of water, if the lives of the passengers and crew are not to be endangered almost as they would be in flying with sea planes above land; and that the use of flying boats is the only way to make of such daring and risky sports a practical trans-oceanic air transport. Dornier planes are used in various services, military and private, on land and sea, in Argentine, Chile, Italy, Spain, Dutch India, Russia, Japan, Jugo-Slavia, Portugal, Uruguay and perhaps other countries, showing that there are good possibilities for a successful airplane designer and builder to market his products in foreign countries as well as at home.



The Dornier Super Wal accommodates 20 passengers and carries a crew of 4, together with the normal freight load and complete radio equipment.



Dual Deperdussin controls are used in the pilots' cockpit of Dornier planes. Note the quadruple motor instrument assembly.

Dornier-Metallbauten build at least twenty-four different types of land and sea-going airplanes, showing the possibilities of specializing in manufacturing airplanes for various services. These types include giant passenger transports in biplane, monoplane and sesqui-plane design with pontoons; monoplane seaplanes; observation biplanes; monoplane transport flying boats; monoplane sport flying boats; monoplane transport land planes; monoplane chasers; monoplane sanitation or hospital planes; etc. It would be impossible to describe here their construction in detail and we will confine ourselves to a few brief data concerning the three most prominent Dornier types.

The Dornier Superwal is the largest and most powerful flying boat in air transport service today. It is propelled by four air-cooled Jupiter VI motors of 500 hp. each. Early this year Wagner established with it 12 world records in respect to speed, flying time and altitude, with useful loads of 1,000, 2,000 and 4,000 kg. A longer flight made with a useful load of 6,000 kg. or about 13,200 lb.

could not be accepted as a world record by the F.A.I. since no provision had been made on their lists for such flying records. The Dornier Superwal is used by the Deutsche Luft-Hansa and the Italian Air Navigation Company; and besides accommodating 19 passengers in two different cabins it has plenty of space for baggage and freight, a radio and navigating room, toilet facilities, etc. The seaplane is able to fly with only three of its four motors as was done on the 800 km. flight from Oslo to Travemunde. The data on the three outstanding Dornier airplanes, giving maximum figures, is as follows:

Data	Merkur	Wal	Superwal
Span, meter	19.6	22.5	28.6
Total length, meter	12.5	17.45	24.6
Total height, meter	3.46	4.35	5.9
Area of wings, square meters	62	97	143
Actual weight, kg.	2100	4100	7450
Normal starting weight, kg.	3500	5750	12000
Maximum starting weight, kg.	3900	6950	14000
Cruising speed, kilometers per hour	165	170	175
Maximum speed, km. per hour	190	190	215
Altitude, meters	5200	4600	3800
Fuel consumption, grams per km.	500	1000	1900
Number of motors	1	2	4
Horsepower of motors	500-600	500-600	480
Fuel carried, liters.	840	1450	3600
Number of crew	2	3	4
Number of passengers	8	10	20

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Second Annual
ALL-AMERICAN AIRCRAFT SHOW
CONVENTION HALL
DETROIT
April 6-14 1929

AVIATION EMBLEMS

Groundman or Mechanic *Civilian Flyer*

Made of silver or gold front (Actual size shown above). Pins or lapels. Price, $1.00 each, mailed anywhere. Identification Wristlets, $2.50

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WRITE FOR CATALOGUES

XUM

airplane company booths as well as in the accessory company spaces.

The Fokker Company had a large number of famous planes reproduced in miniature non-flying scale models. Among these were the famous Southern Cross of the Australia flight fame; the Josephine Ford of the Byrd Arctic Expedition; the Peace America, which Byrd used to fly across to France; a Liberty motored T2 transcontinental record plane, used by McReady and Kelly; and a late Fokker model, the Virginia, taken by Byrd on his Antarctic Expedition.

The Curtiss Company had two small models of the Curtiss Robin, one with a radial motor and the other with a vertical-in-line six cylinder motor. They also had a beautiful Hawk and Falcon scale model.

The Keystone Loening Company had a very small Loening amphibian, probably three or four inches in wing span, as well as a very neat twenty-four inch scale model. There was also a Keystone Patrician three motor model of about thirty-six inches span.

The Boeing Company had a wonderful display of models. A very neat Boeing navy fighter of about twenty-four inches span was shown near a beautiful painting of this airplane in flight. You will recall that this is the plane which holds the world record for climb to ten thousand feet and return in five minutes. This model cost approximately $350.00 to make. There was also a beautiful Boeing tri-motored transport of between forty and forty-two inches wing span, costing about twelve hundred dollars. The company had a six foot model of their mail and cabin combination plane complete with real rubber tires, all controls operating, to the most minute detail, steel propeller of the adjustable pitch type which was fitted with an electric motor, etc. This model was said to have cost twenty-five hundred dollars to build and it certainly was a beauty from the standpoint of workmanship and appearance.

The General Airplanes Corp. had a case of fine models of their new ships, including the Observer equipped with a set of wheels and a set of floats. This was a thirty-six inch model. They also had a Courier model some thirty inches in span, showing both floats and wheels; a model of their tri-motor plane scaling about forty inches, and another twenty-four inch model of their fine little commercial ship. (The Model Editor had the pleasure of taking a "hop" out at the Chicago Municipal Airport in the real ship.)

The N. A. T. had a Ford tri-motor, twenty-four inch model.

The American Airports had a Fokker super-universal and a tri-motor of twenty-four and thirty inch span, respectively.

Berry Brothers, Incorporated, exhibited a number of small fifteen inch Mohawk Pinto models in various colors.

The Goodrich Company had a number of models, the best of them being a Monocoupe and a twenty-four inch Hawk.

The Aero Model Company had a booth in the south wing of the show in which were exhibited, in addition to their regular line of sea plane, cabin plane and Silver Ace models, a new Lockheed Vega type of ship and a new tri-motor job. They have a very beautiful line of ships and report doing quite a business at the show. They had their large six foot Silver Ace model suspended over the booth and it was a big drawing card. Their program includes in addition to the composition Vega, a parasol model.

The Balsa Wood Company had one of the Broadfield Toy Company Air Mail express models, one of the Silver Ace planes, and a balsa wood Spirit of St. Louis, in which the wing was the diaphragm of a loud speaker operating constantly from a radio in their booth.

The Fleischmann Company had a number of models, including a model of Rickenbacker's War Spad, a light German Junkers Bremen type flying model, some glider models, a balsa wood model

This Big 1929 Outfit YOURS for Only $3

BUILDS ANY ONE OF 4 DIFFERENT MODELS

Contains a mammoth set of parts, plans and instructions to build a real flying model of Spirit of St. Louis, Fairchild, Fokker or Bremen. Rubber-tired aluminum wheels. Indestructible aluminum propeller and motor mount. Heavy, multiple-strand Para Rubber motor. Planes guaranteed to stand rough usage, and to fly 300 ft. If instructions are observed. Outfit, prepaid anywhere in U. S., $3.00. (Plans and drawings only 50c.)

How About This Snappy Little $1 TWIN PUSHER OUTFIT?

All parts, drawings and instructions to make it, only $1.00. Has aluminum propellers, two powerful rubber motors, highly cambered 16" wing, and adjustable elevator. Makes a high-powered, long-flying job you'll be proud of!

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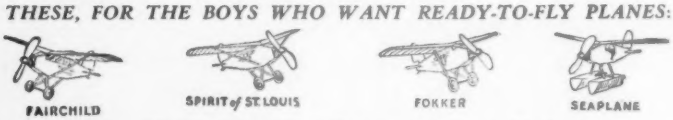
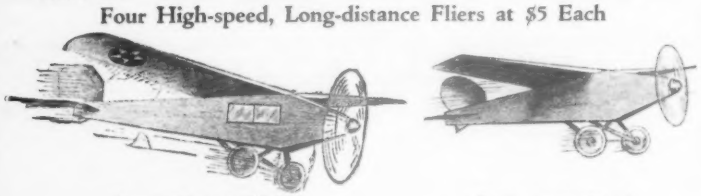


Four High-speed, Long-distance Fliers at $5 Each



Army Scout, $3.50
Fibre wings and fuselage. Aluminum propeller and motor mount. Rubber-tired landing gear. 19" wing spread. Beautiful colors, accurate design, and a fine flier!

Contestor, $2.50
Built much like the Army Scout, but with 17" wing spread. Big favorite with boys all over the country.

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Clinton Model Airplanes

The "MO-CAR" MONOPLANE

A real model airplane — Instruction thru construction

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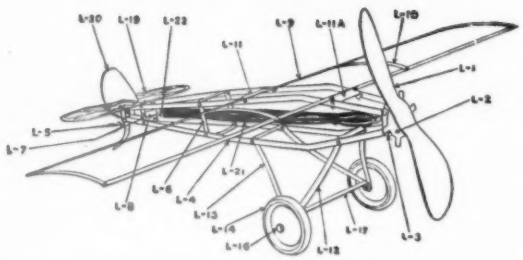

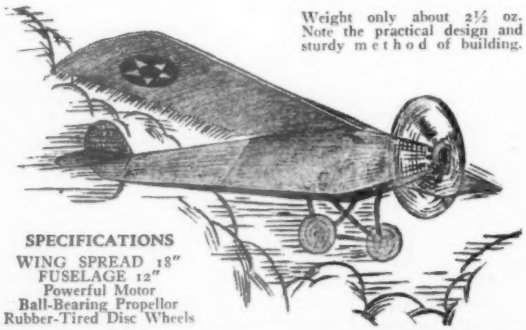

Weight only about 2½ oz. Note the practical design and sturdy method of building.

SPECIFICATIONS

WING SPREAD 18"
FUSELAGE 12"
Powerful Motor
Ball-Bearing Propellor
Rubber-Tired Disc Wheels

THE "MOCAR" Monoplane is a practical, simply designed, real model airplane that *flies*. It is constructed of aluminum parts, all perfectly formed, ready for assembly. No special tools or punches needed for assembly—just pliers. All rivets, bolts, disc wheels, rubber tires, wing and fuselage covering materials are furnished.

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This is an ideal model airplane that offers instruction in both airplane manufacture, and in flying. It is well to remember that all *real* airplanes are first tested by making *models*.

It is great fun to construct and fly "MOCAR" model airplanes

The illustrations above and to the left show skeleton assembly. All parts are plainly marked. Note the sturdy design. The weight, when completed, is only about 2½ oz. Full instructions and illustration for assembly are printed on the board to which the parts are mounted. Shipped complete in box.

The plane has a wing spread of 18", fuselage 12". A very powerful rubber motor, ball bearing propellor of special strong construction and rubber tired disc wheels. All parts made of aluminum.

Set No. 1 is modeled after Lindbergh's Spirit of St. Louis. Construction set, (Postpaid $1.50). Model L made up ready to fly. (Postpaid $2.25.)

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☐ 1 Set No. 1.....$1.50 ☐ 1 Assembled Plane.....$2.25
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Signed name .....

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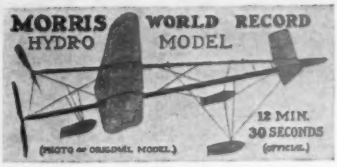
BUILD A GENUINE



KIT everything you need, wire parts formed, select balsa, large drawing, full instructions, only $3.00 or $4.40 with carved propellers—postpaid. Flies as well with wheels or hand launch!

PICTURE, 5"x7" clear close-up—postpaid $1.00.

S.E.5 BIPLANE—Famous War Scout Plane. Flies swell! Looks keen! Special price complete materials with blueprint postpaid $2.95, or with the ribs and propeller completed $4.95.

AMBROID—More for less money. $.35 alone or only $.28 if ordered with other materials.

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FINE BALSA personally selected at kilns, 2"x5"x40", bargain $.95 postpaid.

COMPRESSED AIR MOTORS—Oh Boys! Make real engine driven planes! 3 cyl. motor w't. 1½ oz. only, $4.90 postpd. or all parts & print only $2.50. Special air tanks, $10.00. Tank parts and print, $5.00.

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Send 5 cents for complete parts list. A 5 cent service charge is required on all orders amounting to less than $1. A 5 cent packing charge is required on all shipments of wood or metal greater than 18" in length. Prices are subject to change without notice. All goods sent postpaid in the U. S. A. No stamps or C. O. D. orders accepted.

	Spruce	Balsa
1/16"x1/8"x3'	.03	
1/16"x 1"x3'		.06
1/8"x1/8"x3'	.03	.033
1/8"x1/4"x3'	.045	.054
1/4"x1/4"x3'	.054	.06
1/2"x 1"x3'		.24
1"x 3"x3'		.48
1"x 3"x3 1/2'		.56

Reed 6' lengths, 1/16" diam. .05c; 1/8" .075c; 3/16" .10c; Balsa discs 1/4" thick 2" diam. .07c; 3" .08c; 4" .09c.
Ambroid dope, 1/4 pint .50; 1/2 pint..... .95
Ambroid cement, 2 oz. .33; 4 oz..... .53
Bamboo paper 13x36" .12; 24 3/4"x23 5/8" ..... .14
Rice paper, 18"x24, .09; 21"x25" ..... .06
Wood veneer, 20"x30" ..... .22
Flat rubber 50' of 1/8", .50; 50' of 3/16"..... .75
Piano wire 2' of No. 5 or No. 8, .04; 3" of No. 11 or 15 ..... .06
28-30-32-34 steel wire, per spool..... .10
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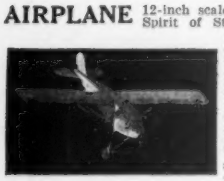
We can supply any size balsa that you need, also propellers, I beams, wing sections, bolts, nuts, screws, brads, aluminum, brass tubing, turnbuckles and books on model building.

AIRPLANE 12-inch scale model of Lindbergh's Spirit of St. Louis. Scientifically designed and very realistic. Equipped with rubber band motor. Rises from ground by own power and flies 30 ft. or more. Easily built without tools. Construction set, with all parts and full directions, postpaid in U. S., only 50c (no stamps). Satisfaction or money back. Send now.



Mann & Benton, 53 W. Second St., Chillicothe, Ohio

float, and several other balsa wood toy novelties.

The Pan American Airport booth had two small twelve inch three motor Fokker ships and a twenty-six inch Sikorsky Amphibion model.

So, in all of the enterprising booths in the show, neat little models were in evidence to augment the interest displayed in the big planes.

Model Whirlwind Engine

The Wright Aeronautical Corporation had a very fine model of the Wright Whirlwind engine. The model was extremely fine, the details being carried down in scale to a most extreme point. The motor was only about 8" in diameter, and carried a small 16" propeller.

The screws which held the rocker arm covers in place were smaller than those ordinarily found in a watch. The minute magnetos were complete in every detail of external appearance. Even the spark advance and retard was arranged so as to operate properly. This motor attracted the attention of everybody, drawing probably more attention, even, than the larger Whirlwind engines on exhibit at the Wright booth.

Our Library and Yours

(*Continued from page 77*)

aeronautical principles. His evidence shows clearly that there was an interest in aeronautics in China at a very early date. Kite-flying, which appears to have been a rather more ambitious undertaking in China than in any European country, was a very early development.

Possibly one of the most unusual methods which has ever been employed by anybody as a means of flying was that invented by Liu An, or Huai-nan Tse, who lived in the second century before our era. He is said to have discovered an elixir which he drank, with the result that he immediately sailed away to heaven. The bowl containing the medicine fell from his hands, and the dogs and chickens having sipped the spilled portion, Liu An was followed in his flight by an escort from his own barnyard.

Dr. Laufer's pamphlet is highly entertaining, and in a time when flying is generally thought of as exclusively a twentieth century affair it is interesting to read of pilots, fabulous or otherwise, who soloed many hundreds of years ago.

Flying in British Columbia

(*Continued from page 81*)

of Canada, with Salmon Arm as their base. They covered about 1600 miles of territory and having completed operations there flew to the northern British

BUILD and FLY MODEL AIRPLANES LEARNING AVIATION

OUR MODEL
of the *Bellanca* in flight

FOR PERFECT SCALE MODELS BUILD AND FLY THESE LISTED BELOW AND MANY OTHERS OF THE U. S. MODELS:

Lindbergh's "Spirit of St. Louis"	$8.50
Bellanca "Columbia"	$9.00
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Balsa or Spruce

1/16" x 1/8" x 3'	0.03
1/8" x 1/8" x 3'	0.03
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For all other sizes and I beams send for free catalogue.

Bamboo paper 25 3/4" x 33 1/2"	0.14
Rice paper 24" x 37"	0.18
Finest quality Silk paper 20" x 24"	0.15
Ambroid Cement 2 oz. 33c; 4 oz. 53c.	
Annealed wire, gauge 34, per spool	0.08

All other goods like rubberstrand, reed, dowels, aluminum in sheets and tubes, bamboo varnishes, are described in our free catalogue. Send for it at once. A 10c charge on all shipments of less than one dollar. For orders of wood always include 10c for secure shipment with our special packing. No stamps or C. O. D. orders accepted, send money order.

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AUGUST SCHAEFER
45 North Ave., New Rochelle, N. Y.

New! A high grade line of indoor and outdoor Model Airplane Kits

We have supplied to many successful model makers, materials to the most exacting requirements for a number of years and now you may reap the benefit of our experience with them.

Supplies and drawings, now ready. Send 10c coin (not stamps) for list. Many new models and supplies that cannot be obtained elsewhere.

All our stock is reasonably priced and no packing or shipping charges are made. This alone should arrest your attention, but when you receive and see our stock we know you will smile a big broad smile.

Yours for better models,

Cleveland Model & Supply Co.
1866PA West 57th St., Cleveland, O.
High Quality—Fast Service

FLY THIS PURSUIT SHIP MODEL!

Light and fast, this one-foot model is a realistic copy of a single seater military pursuit plane. Will rise from ground by own power and fly 60 ft. Can be used indoors or out. Has air service insignia on wings, in colors. Construction set includes ready-made aluminum propeller, shaft, rubber band motor, stream-line wood wheels, pre-cut balsa wing ribs and all other parts, with clear directions. Can be assembled in 3 hrs. by average 14 yr. old boy, without tools. Complete set, packed in unbreakable mailing tube, only 75c, postpaid in U.S. Send check or money order today (no stamps). Print address plainly. Satisfaction or money refunded.

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(We cannot make C. O. D. shipments. No retail catalogue issued)

Columbia territory where similar work was carried on. Photographical work of this nature in B. C. was undertaken more in the nature of an experiment to determine if mapping of this kind was possible in mountainous country. Reports from Ottawa indicated that the work has met with considerable success and as a result of this experiment it is proposed to map the whole of B. C. by this means. Fairchild all-weather cabin monoplanes equipped with pontoons were used by the two air force officers while employed on this work.

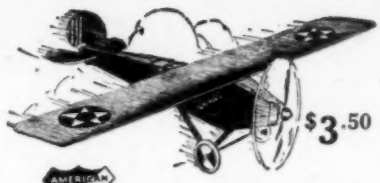
The Jericho Beach air station of the Royal Canadian Air Force has been prominently associated with the pioneering of flying throughout all parts of Canada and just recently two gallant Canadian airmen have returned to the station after a long period spent amid the biting winds and freezing breezes of the Arctic regions. These two men are flying Sergeant N. D. Terry and flying Officer A. J. Ashton, who were detailed to take part with Sergeant Pat Semple in the 15 months adventurous expedition to the Arctic, in connection with the development of the Hudson's Bay railroad.

Throughout 15 months these men kept ceaseless patrol over the bleak and desolate Hudson's Straits, gathering data on the movement of ice, and the constant changes in fog, current and navigation conditions. This information will be used to safeguard grain ships which must come to Port Churchill for cargoes when the new railway is finished. Seaplane bases were established at Port Burwell, Wakeham Bay and Nottingham Island, and these six volunteer Canadian pilots pushed the field of progress northward. The Vancouver air station contributed two of the six.

Not only in capital aviation but also in work and development connected with the industry are there indications of growth on both commercial and private flying on the B. C. coast, and particularly surrounding Vancouver. At present the National Airplane Lumber Company is conducting negotiations with the city council of Prince Rupert, B. C., regarding the progress of the establishment of a special mill by that firm in the Northern B. C. city. Should negotiations be completed satisfactorily the firm will immediately start construction of a plant for the manufacture of airplane spruce.

The Prince George city council have also become air conscious and have approached the B. C. provincial government for assistance in developing a civic airport adjoining the city. Should this project be successfully carried out it will do much to further commercial aviation in British Columbia, as it will give a landing ground for land machines in the interior of the province.

From all indications it is apparent that aviation is steadily increasing in popularity in British Columbia, and that Vancouver city is destined to play a prominent part in the development of commercial aviation in the province.



$3.50

Designed Like and Flies Like a

Real Airplane

Will fly beautifully and is extremely *durable* . . . good for many hundreds of flights without damage.

Has all-metal motor mount, sturdy wings, scientifically designed aluminum propeller and shock absorber landing gear with rubber-tired wheels.

The Scout Model shown above, well packed, will be sent prepaid anywhere in the U. S. for $3.50. Other splendid American Models are: Spirit of St. Louis, Fairchild and Fokker at $5, and the Bremen at $7.50. Every plane tested at the factory and guaranteed to fly and land like a regular plane. Order now and let the fun begin!

Glider Given With Catalogue 10c

AMERICAN PLANES

American Model Aircraft Co.

Dept. 1, P. O. Box 1492
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Spirit of St. Louis

BELLANCA COLUMBIA

FLYING MODELS. 39 INCH WING SPAN WEIGHT 6 OUNCES. DEMOUNTABLE MOTOR STICK

Ready to fly in 8 hours. No steaming, bending or drilling necessary. Ace E. Z. Way eliminates this. Each machine has Balsa ribs; highlift section, ball bearing propeller shaft; propeller is equipped with an aluminum spinner cap; aluminum cowling; aluminum disc wheels; balloon tires; split type landing gear; air cooled motor. Cylinders are not pieces of wood as in other models. Full size drawing with directions. Your choice of blue, red, green, or yellow model. Dope packed in a box 14x27. Postpaid $7.00.

SPIRIT OF ST. LOUIS

33 INCH WING SPAN WEIGHT 4 OUNCES

Flies 700 feet or more. Balsa sides, finished ribs, inside pieces, propeller semi-finished, Balsa disc wheels, Jap tissue, glue and directions. Packed in a box 12x20. Postpaid $4.50.

ACE UNIVERSAL KIT

Builds 6 baby R. O. G. models or most any indoor model described in any magazine. $1.00.

ACE SUPER UNIVERSAL KIT

Will build the Morris Racer, or 33 inch Spirit of St. Louis, S. E. 5 Biplane, Elliot Racer or most any model that is of the duration type. Complete $2.00. 14 sizes of wing sections in stock. Send five cents for catalogue.

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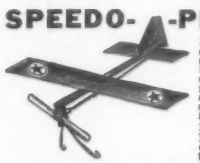

Rises from the ground, soars to great height; comes down in a graceful glide to a perfect landing. Wing spread 16 in. Motor stick 14 in. 7 in. carved wood propeller. Match its performance against your $5 plane. Fully assembled. Only 50 cents postpaid in U. S.

SPEEDSTER AIRPLANE

Fast flyer. Rises from ground under its own power. Speeds beautifully thru the air. 11 in. wing spread. 9 1-2 long. 4 1-2 in. carved wood propeller. Only 25 cents postpaid in U. S.

Both Models Guaranteed to Fly or Money Refunded

Special for this month—Snappy, live rubber, 1-8 in. flat, 1-2 cent per foot; 3-16 in., 1 cent per foot. Postage 5c extra.

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The Red Bomber Combat Plane Free

Positively a sensational offer. Here's the Red Bomber Combat Model Plane, a twin propeller model that flies amazingly. And you can have it free! Boys everywhere are flying model planes. Now is the time to get yours. This sensational plane will fly 600 feet easily, often further. Wings made of special fibre, two powerful rubber motors, two cleverly fashioned propellers. Not a glider—**a real model plane.**

ASSEMBLED IN TWO MINUTES

Best of all no tedious hours of toil constructing. This plane can be put together ready to fly by any boy in less than two minutes—positively! Two minutes after the postman delivers your plane, you can send it into the air diving and dipping, zooming, banking, then soaring to greater heights. Every boy will envy you. Order your plane right now!

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THE OPEN ROAD for BOYS has 50 pages or more every month crammed with stories of aviation, sport, ranch life, high adventure on land and sea, mystery and daring. Great serial stories, interesting articles, jokes and humor. International correspondence club, stamp department and THE OPEN ROAD PIONEERS—nationwide club for boys. Contests galore for all. New, hair-raising detective, mystery serial smash now starting—breathless reading!

Regular subscription price to The Open Road for Boys is $1 per year. We will send you the Red Bomber Combat Plane and a subscription for a whole year—12 fat issues—both for $1. Send the coupon now.

12 Big Issues A Year for YOU

This is A GREAT OFFER →

Both *for* Only $1.00 *use this coupon* ↓

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Friend: By all means I will grab this offer. Enclosed is $1. Please rush me the Red Bomber Combat Model Plane which I understand is free. Enter my name to receive a year's subscription—12 issues—to The Open Road for Boys Magazine beginning with the very next number.

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YOU'LL GET A PLEASANT SURPRISE!

The Flat-Top Lift Curve and Control at Low Speed

By Montgomery Knight and Millard J. Bamber
of the National Advisory Committee for Aeronautics.

THIS report, which is the first of a general airplane safety program, is concerned with the importance of the flat-top lift curve as a factor contributing to safety and control at low speed. An analysis of existing airfoil data indicated definite relations between the shape of the lift curve and certain section dimensions. A section designed according to these empirical relations, was tested and found to have the desired flat-top lift curve, combined, however, with low aerodynamic efficiency and high moment coefficients. The shape of the lift curve at maximum lift appears to be of sufficient importance to justify additional investigation with the view of developing a section having satisfactory efficiency and moment characteristics.

The most critical factor of airplane flight to-day is the making of a safe and comfortable contact with ground or water on landing. The skill required in landing under all possible conditions must be reduced if safety in civil aviation is to be assured. Surprisingly little work has been done to date on this vital matter.

The chief factor to be considered in the problem is the nature of the air reactions upon the airplane as it assumes a landing attitude on approaching the ground. The most important aerodynamic item is the manner in which the lift varies with changes in angle of attack of the wing system at low speeds or large angles of attack. Safety demands that there be no abrupt changes in lift at these angles. In other words, it is highly desirable that the lift curve should have a flap top instead of the relatively sharp peak generally characteristic of airfoils in use at present.

This requirement calls for a study of the aerodynamics of airfoils at large angles of attack. During the past two years such a study has been made at the Langley Memorial Aeronautical Laboratory as a part of a general airplane safety program undertaken by the staff of the atmospheric wind tunnel. The latest is the National Advisory Committee for Aeronautics 84-airfoil-profile, and the major portion of this report deals with the results of force tests on an airfoil model having this profile.

The shape of the lift curve in the vicinity of its maximum depends chiefly on the manner in which the flow separation or "burble" takes place over the upper surface of the airfoil. The design of an airfoil having a flat-top lift curve requires a knowledge of the airfoil shape factors that affect this flow separation. To investigate these factors, preliminary force tests were made on several airfoils having extreme profiles, and from these tests the following tentative rules for obtaining profiles with flat-top lift curves were derived:

(1.) The shape of the upper surface is vital, whereas that of the lower is unimportant; (2.) the maximum ordinate should be well back, in the vicinity of forty per cent of the chord from the leading edge; (3.) the nose should be low and have a fairly small radius of curvature; (4.) the upper surface should be a simple mathematical curve, that is, the change in radius of curvature should be continuous along the surface; (5.) the thickness should be medium, 12 to 16 per cent of the chord.

The National Advisory Committee for Aeronautics - 84 - airfoil - profile was designed in accordance with the above rules. This profile is of the *Joukowsky type and has a medium thickness (8/1 = .05) and high mean camber—(f/1 = .5), with the Joukowsky concave lower surface camber replaced by a straight line.

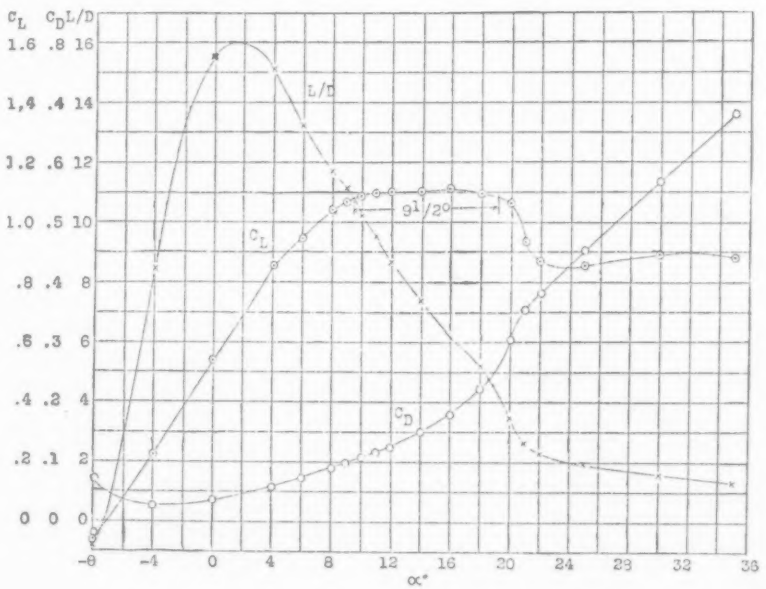
Force tests were made on a 5 inch by 30 inch rectangular airfoil model of laminated mahogany. The model was mounted in the tunnel on the wire balance, and the lift, drag, and pitching moments were measured through a range from —8 degrees to +35 degrees angle of attack. The dynamic pressure q, was held constant at 4.04 pounds per square foot which represented an average air speed of about 40 miles per hour. The average Reynolds Number was 148,000, with the wing chord as the characteristic length.

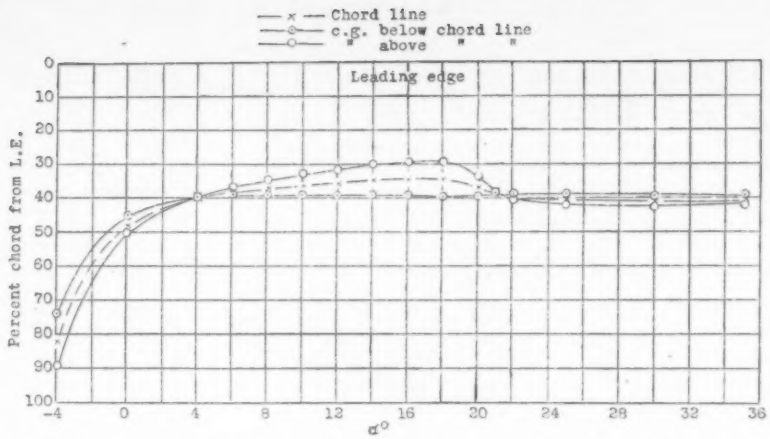
The test results were corrected for the effects of the supporting wires. Also, the effect of the tunnel walls on the air flow over the model was accounted for by considering the test results as applying to a wing of aspect ratio 6.85 in free air. This value for the 30 inch wing in the 60 inch circular closed-throat tunnel was obtained by means of the Prandtl correction formula. The ordinates of the model were accurate to within plus or minus .003 of an inch. In general, the test results may be relied on to within plus or minus 2 per cent.

One of the diagrammatic figures shows that from 9½° to 19° angle of attack, a range of 9½°, the mean variation in lift is about one per cent. An airplane

* "Graphic Construction of Joukowsky Wings" N. A. C. A. Technical Memorandum No. 336.

Lift, drag, and L/D vs. angle of attack. Aspect ratio 6.85.





Center of pressure travel vs. angle of attack. Aspect ratio 6.85.

equipped with this type of wing would have much less critical landing characteristics than if it had a wing with a peaked-lift curve. This is due to the fact that once the flat portion of the curve has been reached, pulling back the control stick would cause neither a sudden rise nor an abrupt drop of the airplane.

A large proportion of airplane crashes to-day may be accounted for by the sudden uncontrolled dive following a stall when close to the ground. This dive is due to the relatively rapid rearward motion of the center of pressure as the angle of maximum lift is exceeded whereby a strong nosing-down tendency is produced. At the same time, due to the low speed, the elevator effect is too small to hold the nose up, and the airplane consequently crashes nose down. This characteristic, in general, is much stronger in staggered biplanes and low-wing monoplanes than in the high-wing monoplane. For the National Advisory Committee-84-airfoil from 4 to 35 degrees the center of pressure is very nearly stationary along a line (A) at a distance of 0.4 of the chord below the chord line. A monoplane with center of gravity on this line would (except for the tail surfaces) be practically in neutral equilibrium over a large range of angles and would have no tendency to nose down. Incidentally, the diagrammatic figures also show the relatively large rearward center of pressure travel that would obtain in a monoplane with the center of gravity on line (B).

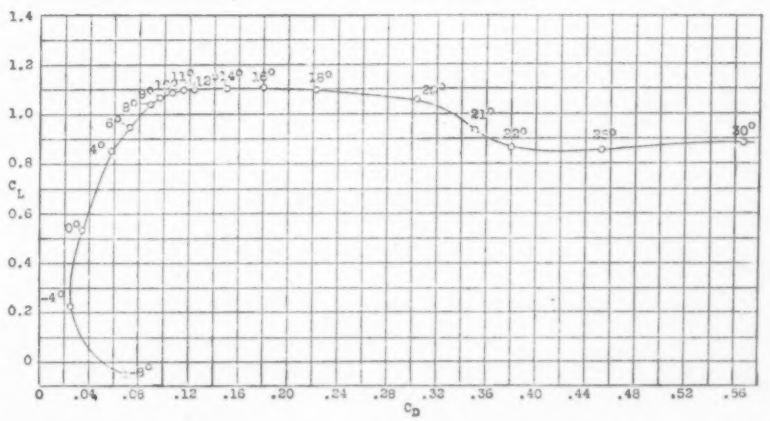
Still another desirable feature of this type of airfoil is its small spinning tendency. Autorotation calculations indicate an approximate range of "rotary instability" of only 4° as compared to that of about 8° or more for several commonly used airfoils.

At zero lift the value of the absolute pitching moment coefficient CM about the quarter-chord point is 0.135. This is larger than is obtained on most of the commonly used airfoils. Moreover, the aerodynamic efficiency is not high, being about the same as that for the well-known Göttingen 387. The investigation is to be continued in order to improve these two undesirable conditions without, however, sacrificing the flat-top lift curve and the good low-speed stability characteristics.

In considering the above discussion, the low scale (R. N. = 148,000) of the tests should be kept in mind. However, it is believed that the scale effect on the National Advisory Committee for Aeronautics-84-airfoil at maximum lift is small. This statement is based on the results obtained on airfoils of approximately the same thickness which have been tested at this laboratory in the variable density wind tunnel.

A study of data now available leads to the following conclusions: (1.) The flat-top lift curve should make landing a safer and less difficult operation; (2.) the flat-top lift curve when combined with a small center of pressure movement at large angles of attack should reduce the tendency to dive after a stall; (3.) an airfoil having a flat-top lift curve also has a reduced tendency to spin and would, therefore, be less apt to fall off on one wing after a stall at low altitude; (4.) owing to the high moment coefficient and low aerodynamic efficiency the National Advisory Committee for Aeronautics-84-section is not considered satisfactory, but satisfactory sections can probably be developed and further work along this line is being planned.

Polar curve for N. A. G. A. airfoil. Aspect ratio 6.85.



New Aeronautical Courses

In view of the increasing importance of air transport in aviation, the Daniel Guggenheim School of Aeronautics of the College of Engineering of New York University is rapidly adding courses relating to air transport to its curriculum according to Professor Alexander Klemin, director of the School.

During the second academic term two new courses will be added to the curriculum at New York University. Professor Myron W. Watkins will offer "Economics of Air Transportation" which will cover the fundamental basis of air transportation. Professor Watkins holds the chair of economics at New York University and is considered an authority on inland water transportation.

Captain C. H. Biddlecombe, one of the most competent authorities on air transport in the country, will offer a course during the second half of the academic year on "Air Transport." Captain Biddlecombe has had operating experience in Europe and in this country. He was identified with the Colonial Air Transport Company and is now actively engaged in the study of air transport problems.

"Air Transport" will include a study of lighting, radio, weather service, communications (other than air), operations and maintenance of flying equipment, accountancy and financial analysis, personnel problems, Department of Commerce regulations, engineering aspects of terminals and emergency fields and the tracing of an airway.

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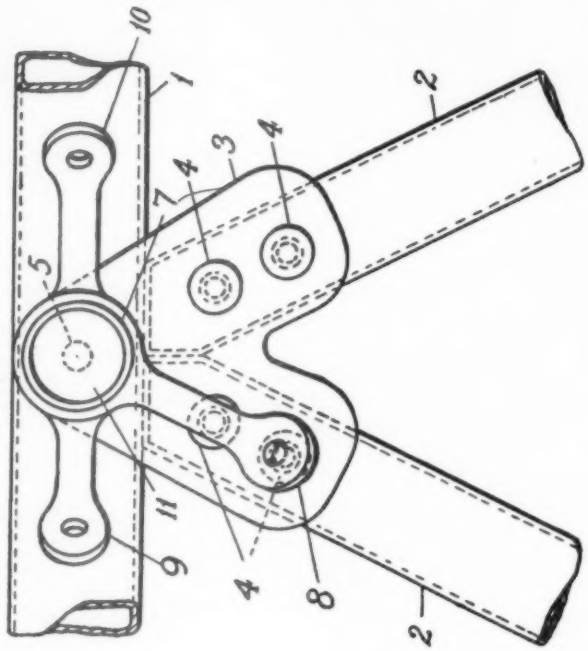
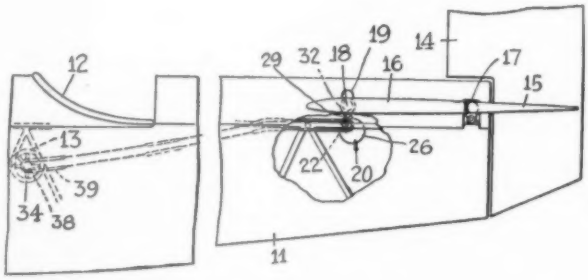
No. 1,691,362, SKELETON STRUCTURE SUCH AS AIRCRAFT FUSELAGE, Patented November 13, 1928, by Frederick Sigrist, of Oxshott, and Sydney Camm, of Long Ditton, England.



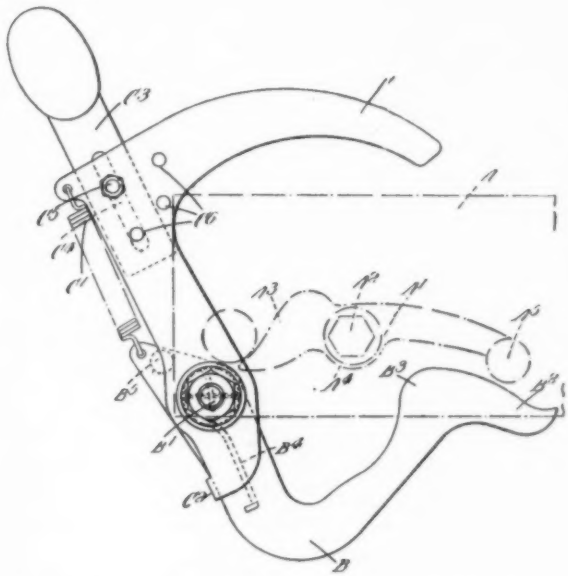
According to this invention the longerons of a fuselage and the interlongeron struts or bracing members are formed of metal tubes which are squared or formed with flats at the joints or which are of square, flattened or rectangular cross section throughout their length. The longerons and the bracing members or struts in either the vertical or horizontal bracing or both may be connected together at each joint by plates bolted or riveted to each of the adjacent members.

No. 1,691,376, STABILIZER ADJUSTING MECHANISM, Patented November 13, 1928, by Daniel J. Brimm, Jr., of West Hempstead, New York, Assignor to Ireland Aircraft Inc., a Corporation of New York.



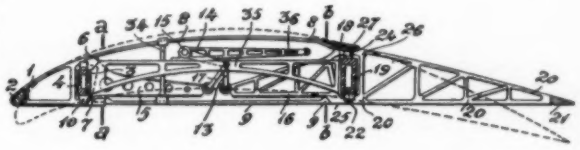
A stabilizer adjusting mechanism including a rotatable eccentric over which is loosely arranged a non rotatable band, the band being held against rotation by its attachment to the stabilizer and being movable under the influence of the eccentric to adjust the stabilizer as said eccentric is rotated.

No. 1,691,494, AUTOMATIC GUN CARRIED BY AIRCRAFT, Patented November 13, 1928, by Harold James Payn, of Weybridge, England, Assignor to Vickers Limited, of Westminster, England.



This invention relates to automatic guns carried by aircraft and of the kind provided with a cocking and loading lever which is under the control of the gunner and serves when actuated to reproduce the movements of the barrel and the gun mechanism which occur during firing so that the gun can be initially cocked and loaded and can also be cocked and reloaded in the event of a cartridge misfiring, this operation causing the defective cartridge to be extracted and ejected. In addition to this patent a further design for an automatic gun carried by aircraft has been patented by the same patentee, also on November 13, 1928, the second patent being No. 1,691,495.

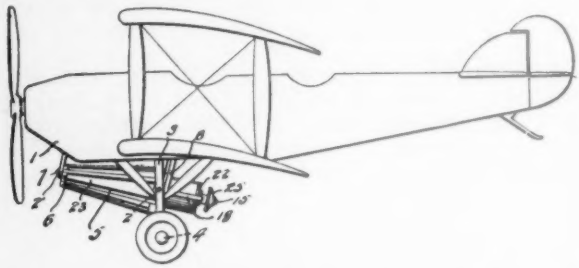
No. 1,690,765, CONSTRUCTION OF FLEXIBLE AEROPLANE WINGS WITH VARIABLE PROFILE, Patented November 6, 1928, by Ugo Antoni, of Viareggio, Italy.



Means are generally known for varying the profile of aeroplane wings with the object of obtaining a quick change of speed and a variation of the carrying capacity of a wing

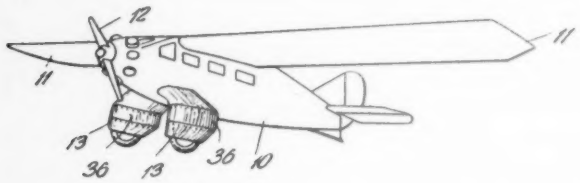
at the will of the pilot. The present invention, however, relates to the proper construction of the wing, substantially consisting of two parts, one with a variable profile controlled by the pilot, the other automatically flexible.

No. 1,690,791, Bomber Attachment for Aeroplanes with Gas Bombs, Patented November 6, 1928, by Archie F. Nair and Hobart A. Nair, of Glendale, California.



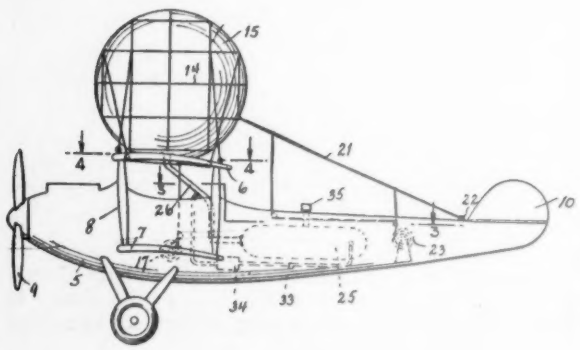
It is one of the purposes of this invention to provide a type of bomb which will effectively destroy itself so that no one may know how the bomb is constructed. Special mechanism is provided whereby the bomb may be readily and quickly released when desired from the airplane and to provide means for supporting the bomb in a position convenient to the engine of the aircraft.

No. 1,691,105, Landing Gear for Airplanes, Patented November 13, 1928, by Giuseppe Mario Bellanca, of Passaic, New Jersey.



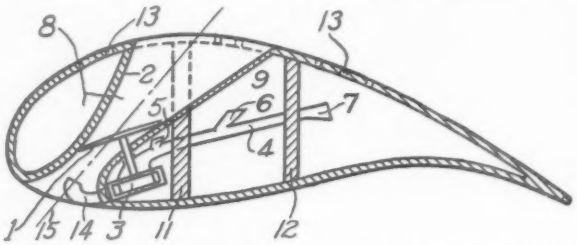
The construction disclosed in this patent has for its purpose to overcome the difficulty that has been found in accommodating the landing gear structure to the contour of fuselage frameworks of different sizes and inclinations and at the same time to provide a vertical disposition of the landing wheels with a sufficient lateral spacing between them to provide a desired stability.

No. 1,691,709, Safety Device for Aeroplanes, Patented November 13, 1928, by Piroska Eller and John Eller, of New York, New York.



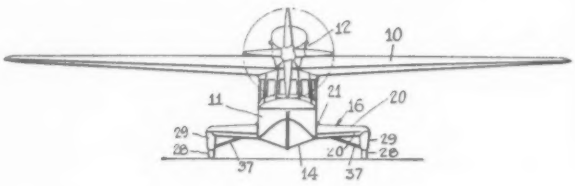
A safety device for airplanes in which a collapsible and inflatable envelope or balloon is located on the top of the wings of the machine, the balloon having an outer network and attached cables whereby they may be released. Provision is made for quickly inflating and deflating the envelope or balloon from helium storage tanks carried in the fuselage.

No. 1,691,942, Airplane Wing, Patented November 20, 1928, by Edward A. Stalker, of Ann Arbor, Michigan.



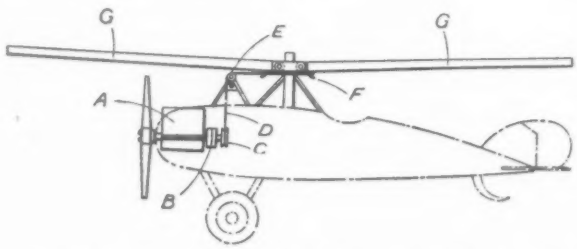
This invention relates to the augmentation of the wing lift by sucking off the boundary layer, and more particularly to an efficient and safe means of accomplishing this suction, by means of a centrifugal blower driven by the flow of air through a turbine located in a suitably designed passage in the wing, thereby utilizing the difference of pressure existing between the upper and lower surfaces of the wing.

No. 1,692,010, Retractable Landing Gear, Patented November 20, 1928, by William Wait, Jr., of Garden City, New York, Assignor to Curtiss Aeroplane & Motor Co., Inc., a Corporation of New York.



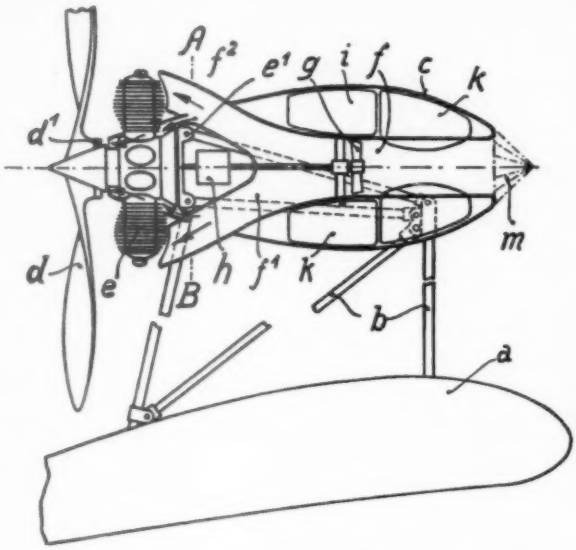
Retractable landing gear for amphibian aircraft, wherein the mechanism is, in a sense, supported by stub wing surfaces. These stub wing surfaces serve a three-fold purpose. When flying they add to the total wing or supporting surface area; when hydroplaning they function as auxiliary hydroplanes; and when operating as a land plane they provide a support for the landing wheels.

No. 1,692,081 and No. 1,692,082, Aircraft with Rotative Wings, Patented November 20, 1928, by Juan De La Cierva, of Madrid, Spain, both patents disclosing further improvements in aircraft with rotative wings.



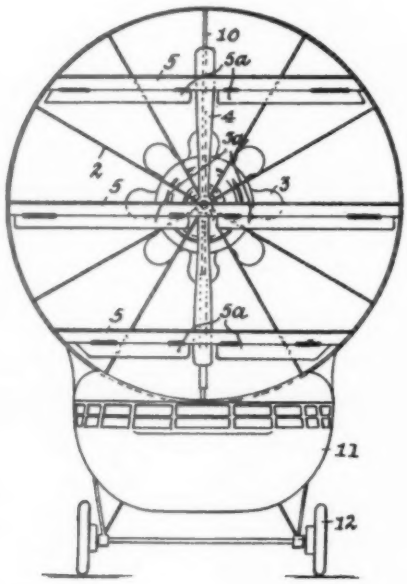
These are additional patents just granted to the well known Spaniard who flew across the English Channel in his especially designed craft which has been termed an autogiro. The present patents are drawn to specific details of wing construction or to means for setting the special wing system rotating before the aircraft commences its advance prior to taking off.

No. 1,691,593, AIRCRAFT WITH PUSHER SCREW, Patented November 13, 1928, by Kurt Tank, of Potsdam, New Berlin, and Karl Frydag, of Schmargendorf, Near Berlin, Germany, Assignors to The Firm: Rohrbach Metall-Flug-Zeugbau, G. M. B. H., of Berlin, Germany.



A special construction and arrangement of the power plant for aircraft, enabling the use of air cooled engines of the stationary type with pusher screws. The engine is arranged in the rear part of the engine nacelle, quite close to and in front of the pusher screw and substantially on the same axis and the cooling of the engine is solely by the air.

No. 1,693,159, AEROPLANE, Patented November 27, 1928, by Gustav Rickelmann, of Haledon, New Jersey.



This patentee utilizes a substantially cylindrical hollow body or structure as the lifting medium for the aircraft and combines therewith a plane or lifting surface placed forwardly and rearwardly of the cylindrical structure for increasing the lifting power of the machine.

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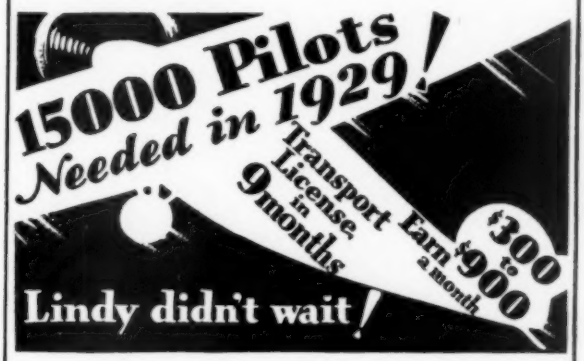

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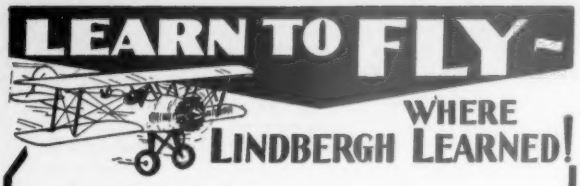

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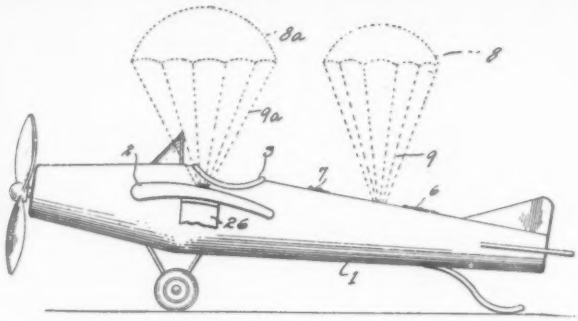
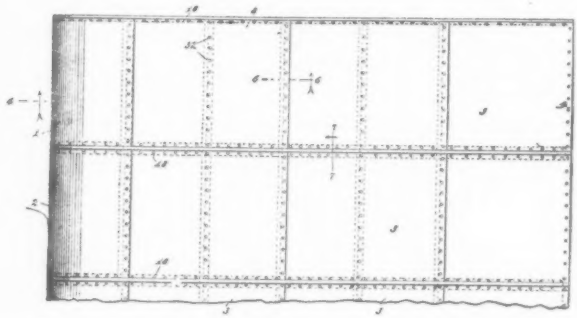
No. 1,692,108, AEROPLANE SAFETY DEVICE, Patented November 20, 1928, by Hermann Bergmann, of Detroit, Michigan.



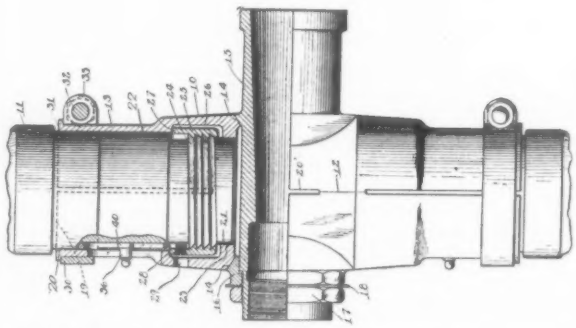
Dual parachute arrangements within an aircraft, equipped with means for quickly bringing the parachute into operative position for retarding the fall of the airplane in the event of its getting out of control while flying.

No. 1,693,449, AIRPLANE WING STRUCTURE, Patented November 27, 1928, by Henry Joseph Le Pul, of Hempstead, New York.



An airplane wing structure providing a plurality of independent covering sheets arranged with the thickest sheets at the point of greatest strain and the thinnest at the point of least strain, thereby providing for a variance in weight and strength to take care of the different loads.

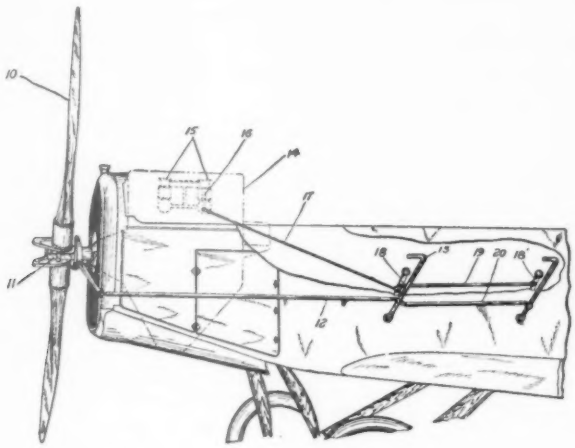
No. 1,693,450, AIRCRAFT PROPELLER, Patented November 27, 1928, by Ernest G. McCauley, of Dayton, Ohio.



One of the principal objects of the invention is to provide an adjusting nut on the inner end of the propeller blade permitting easy endwise adjustment of the blade in the socket in changing the diameter of the propeller or in securing horizontal balance, a special feature consisting in the provision of means whereby the nut may be secured against turning with

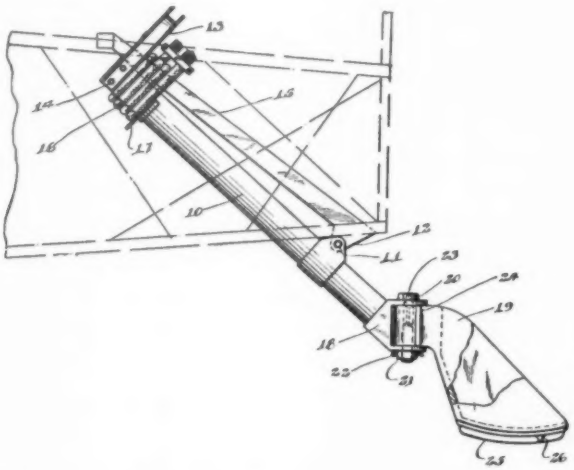
respect to the blade after the endwise adjustment when securing the proper pitch setting of the blade or for holding the nut with the socket to enable the turning of the blade in the nut in the endwise adjustment of the blade.

No. 1,693,451, PROPELLER CONTROL MECHANISM FOR REVERSIBLE OR ADJUSTABLE PITCH PROPELLERS, Patented November 27, 1928, by Ernest G. McCauley and Frank W. Caldwell, of Dayton, Ohio; Said Caldwell Assignor to Standard Steel Propeller Company, a Corporation of Delaware.



This invention relates to a synchronizing mechanism for aircraft, ship or other craft propelling means whereby a reversible pitch propeller may be controlled together with the throttle valve of the engine or the power means control. More particularly the invention relates to a combined safety device for initial change of propeller pitch and for relatively automatic throttle and pitch control subsequent thereto, to and from a pull reversed pitch position of blades.

No. 1,693,503, TAIL SKID FOR AIRPLANES, Patented November 27, 1928, by Charles W. Dworack, of Dayton, Ohio.



This invention relates to tail skids for airplanes, and is generally concerned with the provision of a practical form of skid affording a support for the tail which renders the operation of turning on the ground less difficult so that manual assistance is unnecessary and wherein the worn portion of the skid may be renewed with minimum labor.

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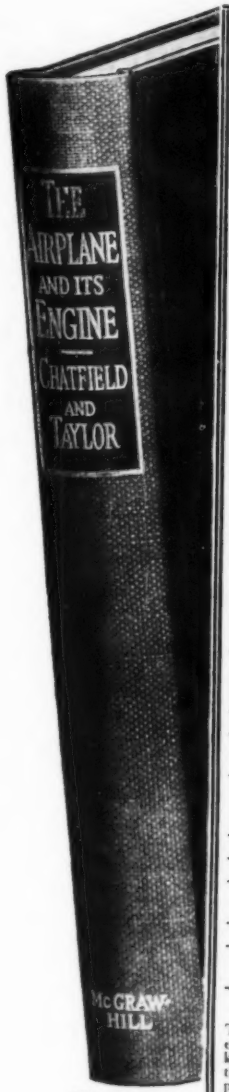

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